7801

JAN 6 1911

PUBLIC LIBRARY OF DETROIT

SIXTY-SEVENTH YEAR

SCIENTIFIC AMERICAN

THE WEEKLY JOURNAL OF PRACTICAL INFORMATION

VOLUME CIV.
NUMBER 1

NEW YORK, JANUARY 7, 1911

10 CENTS A COPY
$3.00 A YEAR

"IVAN." HE IS FROM ALASKA AND IS ONE OF THE BIGGEST BROWN BEARS IN CAPTIVITY

Photograph by Walter L. Beasley

See page 11

SCIENTIFIC AMERICAN

Founded 1845

NEW YORK, SATURDAY, JANUARY 7, 1911

Published by Munn & Co., Incorporated. Charles Allen Munn, President; Frederick Converse Beach, Secretary and Treasurer; all at 361 Broadway, New York

Entered at the Post Office of New York, N. Y., as Second Class Matter

Copyright 1911 by Munn & Co., Inc.

Subscription Rates

Subscription one year $5.00
Postage prepaid in United States and possessions, Mexico, Cuba, and Panama
Subscriptions for Foreign Countries, one year, postage prepaid, 6.50
Subscriptions for Canada, one year, postage prepaid, ... 5.75

The Scientific American Publications

Scientific American (established 1845) . . . . . per year, $5.00
Scientific American Supplement (established 1876) . " " 5.00
American Homes and Gardens . . . . . " " 3.00
The combined subscription rates and rates to foreign countries, including Canada, will be furnished upon application.
Remit by postal or express money order, bank draft or check, Munn & Co., Inc., 361 Broadway, New York.

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

The purpose of this journal is to record, accurately and in simple terms, the world's progress in scientific knowledge and industrial achievement. It seeks to present this information in a form so readable and readily understood, as to set forth and emphasize the inherent charm and fascination of science.

A Great Work Nobly Done

OF all the constructive works of magnitude undertaken by the United States, the building of the Panama Canal stands to-day, and probably will stand for all time, as the most difficult, the most stupendous, and, in view of its successful execution, the most admirable.

A dozen years ago, the name "Panama" was the synonym for disease, disaster, and the ruin of great reputations. The French engineers, with the renowned De Lesseps at their head, and flushed with the successful completion of the great Suez Canal, had but recently gone down to utter defeat in the attempt to cut a waterway across the Isthmus.

Realizing the importance and the inevitableness of a trans-Isthmian canal, and accepting the failure of the French as a demonstration of the impossibility of successfully cutting a canal at Panama, the United States was investigating an independent route through Nicaragua. Surveys had been made and engineers of reputation had reported that the plan was feasible. Nicaragua, moreover, was commended strongly to the American people by the fact that to construct a waterway by this more northerly route was to attack the problem on a new plan and in a different location, and thus to stamp it as a purely American undertaking. The first surveys, necessarily imperfect in scope and lacking that detailed information which is necessary to determine the feasibility of an enormous undertaking of the kind, were received, not merely by the general public, but by the engineering and technical press of the country as a whole, with premature approbation; and only a dozen years ago, it looked as though the country would be committed at once to the construction of the canal at Nicaragua—a move which would have invited disaster as great as that which marked the French *debacle* at Panama.

It was at this critical time that an army engineer, General Ludlow, in a report to Congress, drew attention to the great magnitude and perilous uncertainty of the problems involved in constructing a canal 110 miles long, great stretches of which would have to be supported by embankments and retaining walls of unprecedented dimensions. Simultaneously, another army engineer of great distinction, General Abbot, startled the American people by boldly announcing that the only practical route for a canal was that which had been selected by the French at Panama. General Abbot showed that, as between the two routes, there was everything to be said in favor of that one upon which the French had made such signal failure.

At the very first reading, the facts and arguments set forth by these two gentlemen appeared to make out such a strong case in favor of the more southerly route, that the SCIENTIFIC AMERICAN immediately made a careful investigation, with the result that this journal indorsed everything that the army engineers had set forth, and from that time on became a most earnest advocate of the Panama route. At this juncture, however, the general American public, the technical press of the country, and Congress itself, were favorable to Nicaragua. Certainly they were in no mood to consider the question of purchasing the French failure, with a view to carrying the work to completion. Yet it has rarely happened that the old adage that truth will prevail has received a stronger exemplification than in the history of the Panama-Nicaragua canal controversy. Slowly but very surely the facts began to assert themselves, and in spite of bitter opposition, born partly of the national prejudice in favor of constructing an entirely new canal, partly of the opposition of powerful interests that were behind the Nicaragua project, and largely, of the supposedly threatened interests of trans-continental railways, there was a gradual and inevitable recognition of the fact that the Panama route was the only feasible one for the great waterway.

In spite of the confusion and false starts, which seem to be inevitable in opening up a vast and complicated work of this character, the drawing up of the plans and subsequent execution of the work has been carried through in a manner that reflects the greatest credit upon the wisdom and the farsightedness of the engineers employed on the various Isthmian Canal Commissions, and upon the engineer corps of the United States army, who are carrying the work forward to a sure and highly satisfactory completion.

In all the literature of engineering, no more entertaining or instructive chapter will ever be written than that dealing with the controversy which raged around the question of a sea-level versus a lock canal. It was at once a stroke of genius and daring, when our engineers, in spite of the recommendation of an international commission in favor of a sea-level canal, decided to build a summit-level-and-lock canal, involving the construction of the greatest dam and the largest artificial lake on record, and to build it with a depth and width of prism far beyond anything hitherto attempted.

The bitter and unjust criticism to which this great venture was subjected in the early days of its construction is a matter of comparatively recent history. Disappointed contractors, politicians, capitalists who were interested in the rival route, transportation interests, and above all, the sensational magazine writer, joined hands to decry both the plan of the work and the method of its execution. The clamor was not without its effect upon the nation and the Federal Government. From time to time, to quiet the public unrest, commissions, expert and otherwise, were sent down to the Isthmus to see with their own eyes and report on conditions. In every case, both the plan and its method of execution were warmly endorsed. The latest verdict of approval was that of the Institute of Mining Engineers, which, on its recent return from an excursion to Panama, has published over the names of some of its most eminent representatives, a complete approval of everything that is being done at the Isthmus.

This cumulative approval by eminent politicians, including the President himself and leading members of both houses; by financiers; by men interested in transportation by land and sea; and above all, by leading engineers both here and abroad, has had its effect. The American people have settled down to the conviction, not only that the work will be done on time, but that it will stand forever as the most monumental engineering achievement of this or any other age.

A Step Backward

IT is with positive consternation that we learn of the determination of the Navy Department to place reciprocating engines in the new battleship Texas, contract for which is to be awarded to the Newport News Shipbuilding Company. The data issued by the Navy Department for the bids on this vessel show, on the plans, both Parsons and Curtis turbines, and the specifications were all made on the basis of turbines. Presumably the object of the Navy Department in going back to a type of engine which has been discarded by all the navies of the world, is to economize in fuel; the reciprocating engine in our scouts and battleships having shown itself to be at cruising speeds more economical than the turbine.

It should not be forgotten, however, that the turbines installed in the "North Dakota" represent an early form, and do not compare in economy with the improved type which the contractors were prepared to place in the "Texas." The steam consumptions, guaranteed for the purpose, are nearly 20 per cent better at cruising speeds than were guaranteed and obtained in the case of the "North Dakota." Moreover, the guarantees for the Parsons type of turbine were only about half a pound more at the maximum speed and about three pounds more at the lowest speed than the Curtis guarantees. The guaranteed economy, therefore, is superior to that obtainable with reciprocating engines at the maximum speed, and at least as good, if not better, than those obtainable at cruising speed. This being so, we are at a loss to understand why the navy should have reverted to a discarded type of motive power in this, our latest ship of 27,000 tons displacement. The turbine is more reliable, particularly when the engines are being driven at maximum speed; under which conditions the engineers in charge of reciprocating engines are in constant dread lest the failure of some minor part, some pump, valve rod, or lesser mechanism, will put the engines entirely out of commission.

Are Great Britain, with her vast experience; Germany, with her ambitious program; France, which is now entering upon large dreadnought construction, and Japan, cautious, intelligent and carefully selective—are they all courting disaster in committing themselves exclusively to the turbine? For this is what they have done, if we are to believe the report of the Secretary of the Navy for this year, which in speaking of foreign shipbuilding programs says, "Turbines are universally adopted as the mode of propulsion." Certainly the odds are strongly against the engineers of our navy in taking a step of such tremendous significance as this. The subject is one which may well be commended to the serious and exhaustive inquiry of a joint naval committee of both houses.

The fatuity of the action of the department in this matter was very aptly put to the writer by one of the leading naval architects of the world, when he said, "I had supposed that the advantage of the turbine for sustaining high speed was an important battle consideration; but it seems to me that the navy of the United States should now prepare a signal, for hoisting when meeting an enemy at sea, which will read, 'Please don't disturb us; we are proceeding at our most economical speed.'"

Prospects of Trunk Railroad Electrification

THE long silence of the New York, New Haven & Hartford Electric Railroad regarding the cost of operation of its electric system between Stamford and New York, has grown to be significant; for it has been realized that, if the economies which it was hoped electrification would show, as compared with the results obtained under the old steam operation, had been obtained, the company would have been only too pleased to make an announcement to that effect. Both the New York Central & Hudson River Railroad Company, which equipped its suburban and terminal lines with a direct-current system, and the New Haven, whose installation is of the alternating-current type, have testified to the great benefits of an operative and general physical character which have resulted from the change; but until very recently neither of these roads has made public the eagerly awaited figures on the relative costs of operation.

The Legislature of Massachusetts some time ago directed the railroad companies operating within the metropolitan limits of Boston to make plans for the electrification of their passenger service in the district, and submit the results of their studies to a joint board on metropolitan improvement. This has brought forth from the New Haven Company the statement that the estimates for the complete equipment of the New Haven and the Boston & Maine railroads, within the Boston metropolitan district, amount to a total of $32,751,942. It is pointed out that the proposed restriction of the electrical operation to the metropolitan district has but little relation to the flow and volume of traffic, and that it would render necessary the establishment of costly intermediate terminals at some thirteen different points on the boundary of the metropolitan district for accommodating both steam and electric motors. All trains passing through these transfer points must be subjected to a delay of three or four minutes in both directions.

Then follows an interesting reference to the results obtained at New York, where, it seems, in spite of the more favorable conditions, due to the greater density of traffic and the simpler track system, the records of the New Haven Company demonstrate that, under present conditions, where a joint steam and electric service is being maintained, the electric train service not only fails to earn any interest upon the large amount of capital invested, but that it has also increased the cost of operation.

Mr. McHenry goes on to say that no general substitution of electric for steam traction should be made unless the substitution is complete, including passenger and freight operation, and yard switching in addition. He also urges that in making such substitution, the operation should include the full length of run or engine district.

A Flying Machine in Leash

THE race for the Gordon-Bennett trophy is a thing of the past now. We all know how the "Baby Wright" came to grief at the very start; how Leblanc crashed into a telegraph pole just as he had victory in his grasp; and how Grahame-White carried off the trophy by a curious combination of luck and doggedness.

Those who were privileged to take their stations near the aeroplane sheds, behind the scenes, as it were, of that stage where a great play was enacted, still remember with interest the preparations that were made. For hours and hours beforehand, mechanics were busy in the hangars. They scrutinized the motors with meticulous care; for upon them the outcome depended. They tested the steel cables that warped the wings; for if one of those wires broke, the machine would inevitably crash to the ground. They examined every nut, every bolt, every square inch of wood, until they knew to a certainty that the machines were in absolutely perfect trim. After the signal to start. One end of the rope was released, and the machine shot forward. For perhaps two hundred feet it bowled over the turf at more than automobile speed. Then the steering column was moved ever so little, and the machine rose into the air.

How an Artist Discovered a Natural Law

IT is a curious fact that an extremely interesting natural law was discovered and brought to the attention of scientists by an artist, Thayer, who was also a close student of bird life. With an artist's eye for light and shade, Mr. Thayer hit upon what the naturalists, despite their intimate familiarity with the many varieties of imitative and protective coloration in animals, had failed to discover, i. e., the reason why the under parts of fishes, reptiles, mammals, birds, and, in many cases, even insects, are so generally white or light. This natural law has been briefly stated as follows: "Animals are painted by nature darkest on those parts that tend to be most lighted by the sky's light, and *vice versa*."

In the open, it is true, the light commonly comes from above, and thus the majority of wild creatures are darker on their backs and lighter below, where the shadow of their own bodies upon the lighter color tends to equalize it with that of the upper parts. Thus, in the case of a dead bird with wood-colored back, the lighter shades on wing and sides and a white breast may look, when held in the hand, as if the conspicuous silvery appearance of the breast feathers would betray it to the eye of a searching enemy. But, in reality, such is not at all the case. It would be much more easily discovered were it dull brown all over. This curious fact was brought out by Thayer, and at an open-air meeting of ornithologists he conducted a series of cleverly devised experiments.

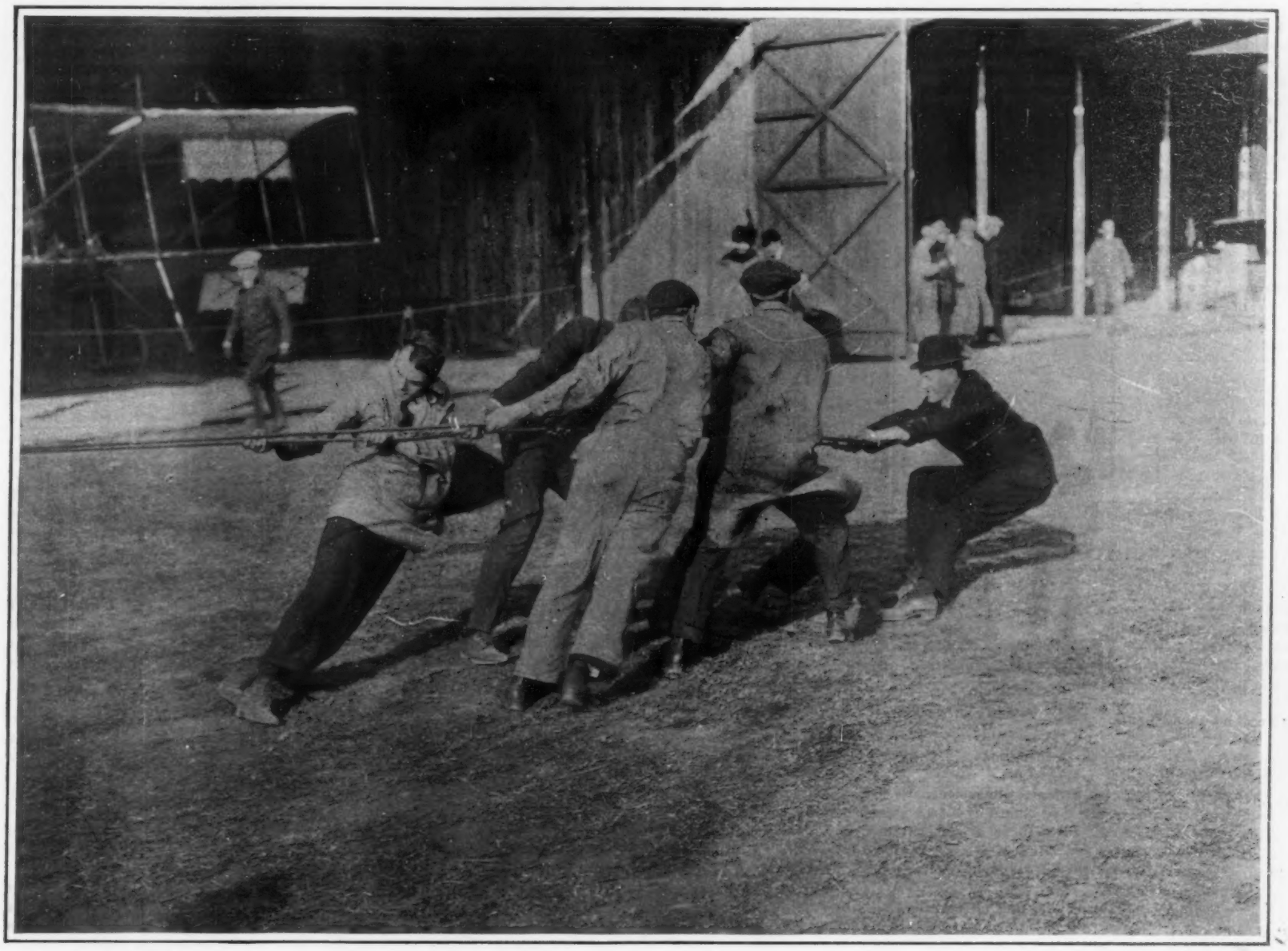
Three objects, about the size and shape of sweet potatoes, were placed horizontally on wires a few inches above the ground. They were covered with a sticky material, and then dry earth from the road where they stood was sprinkled over them to give them the very color of their background. The two end ones were painted white on the under side, and the white color was shaded up and gradually mixed with the brown of the sides.

When viewed from a little distance, these two end objects, which were white below, disappeared from sight, while the middle one stood out in strong relief and appeared much darker than it really was. It was explained by the investigator that birds and mammals, which are protectively colored, have the under parts white, or very light in color, and that the color of the under parts usually shades gradually into that of the upper parts. This is essential in order to counteract the effect of the shadow side, which otherwise, as shown by the middle object, makes the object abnormally conspicuous, and causes it to appear much darker than it really is.

Certain of the observers of these experiments could scarcely believe that the striking difference in the visibility of the three objects was entirely due to the coloring of the under side, and accordingly Mr. Thayer was requested to color the middle one like the two others, in order that the effect might be observed. This was done, and the under side of the middle object painted white, the white being shaded well up into the sides, as in the case of the others. The effect was almost magical. The middle object at once disappeared from view.

Similar experiments were made on a lawn. Two potatoes were painted green, to resemble the green of the grass above which they were suspended. One was painted white on the under side, and at once became invisible when viewed from a little distance, while the other showed plainly and seemed very dark, the shadow, added to the green of the under side, making it extraordinarily conspicuous.

The rule of natural coloring which the artist proved like a scientist is general throughout the animal kingdom, and of much importance in preserving species from destruction.



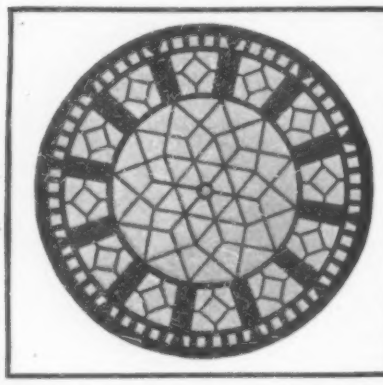
Photograph by the Pictorial News Co.

When the propeller of a high-powered flying machine is started, several men are needed to hold the machine in leash, as it were. The machine which these six men are struggling to hold back is Grahame-White's 100-horse-power Bleriot monoplane in which he won the Gordon-Bennett International trophy.

SIX MEN AND ONE HUNDRED HORSE-POWER

they had completed their work, the aviators themselves began an inspection no less painstaking and minute.

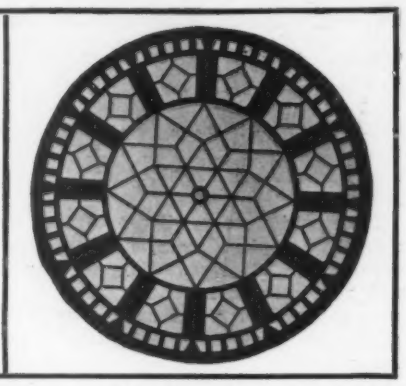
Grahame-White, for example, went over every part of his machine with a degree of care that must have seemed ridiculous to a layman. He shook the wings; he shook the frame; he shook the tail members in the effort to discover some loose part. He tapped the fuel tank and peered into it to see that it was full. He looked over every square inch of the propeller blades. At last he climbed into his seat. Six men seized a rope that trailed behind the machine. A man stepped forward and gave the propeller a twist. The 100-horse-power engine spluttered a moment, and then its fourteen cylinders, together with the propeller blades, spun around at the rate of 1,200 revolutions a minute. The machine leaped forward like a racehorse. To hold it back, the six men in the rear strained every muscle. For half a minute or so they were engaged in this tug of war. Then Grahame-White, with a characteristic eloquent gesture, gave



A Huge Electrically Driven Clock

A Timepiece That Served as a Dining Table

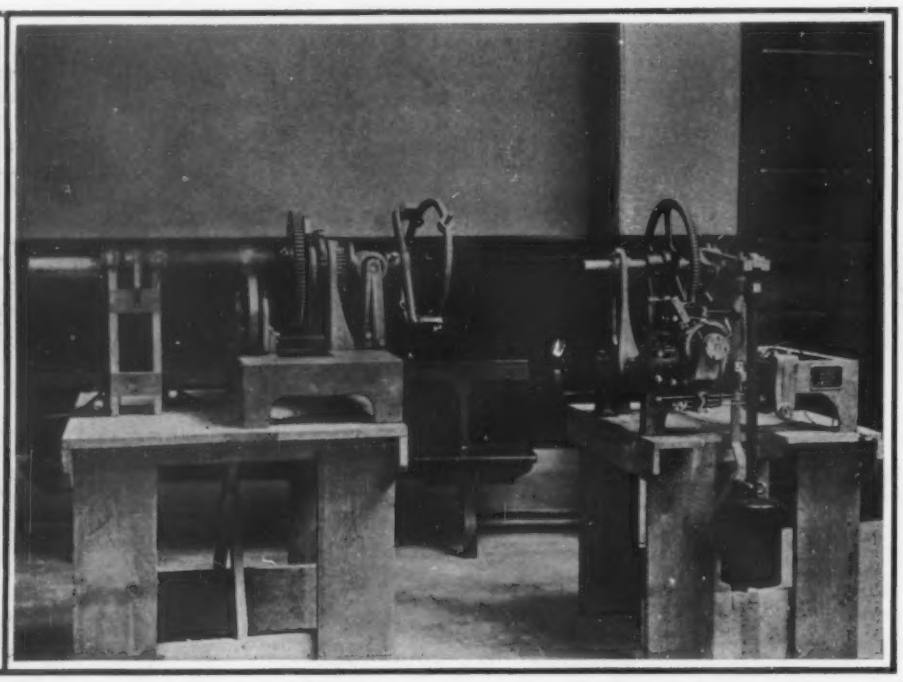
By the English Correspondent of the Scientific American



AN electrically driven clock, which is the largest in England, has recently been completed in Leicester, England, to adorn the tower of a new building that is now approaching completion. The time-piece possesses many interesting features, especially in connection with its mechanism.

The clock is provided with four dials—which will be set 220 feet above the sidewalk. Each dial measures 25 feet in diameter. Owing to the exposed position of the clock, and the heavy gales that prevail in the neighborhood of Liverpool, special attention was devoted to structural strength of the clock face. The framework of each dial is of massive iron construction, and weighs 3½ tons. The opal glass is of great thickness, so that it may withstand a minimum pressure of 11 tons per square inch, that for each dial weighing 660 pounds. The outer circle of the dial is constructed in twelve sections, each of which measures 6 feet 3 inches long by 5 feet 6 inches wide. The minute spaces are 14 inches apart. Instead of using Roman or Arabic numerals to indicate the hours, a solid black uniform mark is utilized, rendering the time readily distinguishable from a distance. Each of these chapters is 3 feet 6 inches in length by 18 inches wide.

One of the hands



Part of the simple and ingenious driving mechanism of the clock

The hands are likewise of large dimensions. Each minute hand measures 14 feet in length by 3 feet wide at the broadest part. They are made of copper, but to enable them to withstand wind pressure, and the forces of rain and snow, they are stiffened with a 9-inch gunmetal backbone.

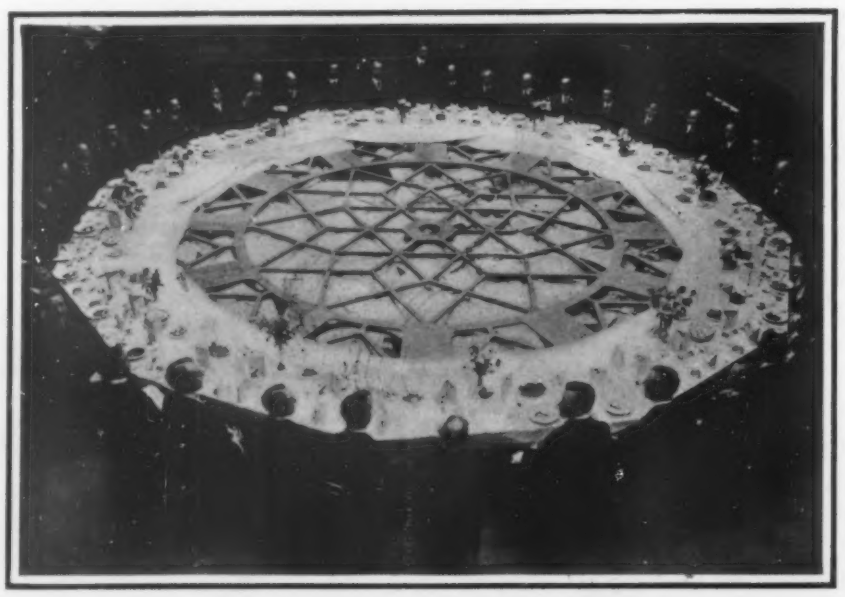
When the clock was completed, the builders invited a number of friends to participate in a celebration luncheon under novel conditions. One of the large dials was supported on legs, to serve as a dining table, round which some forty people were comfortably seated.

Apart from its unusual proportions, the most striking feature of this horological novelty is its driving mechanism, which is small, compact, occupies little space, and is exceedingly simple, weights and intricate arrangements of wheels being entirely eliminated. Winding is also dispensed with. The principle upon which it is constructed is the same as that employed to drive a small dining-room clock.

This system is called the "waiting train" movement, evolved by the makers, and the outstanding feature is that the time-keeping portion of the clock is disconnected from that of the hand-driving. This arrangement effectively overcomes any interference by rain, wind, or snow, which might tend to retard the forward movement of the hands. The clock is driven with a practically continuous motion, but its design secures the separation of the time-keeping element of the clock from the hand-driving element, with the desirable result that any untoward effect brought to bear upon the hands cannot react upon the time keeping. The motion of this mechanism is governed by a precision time transmitter, the invention of the builders, which is now being so extensively employed for observatory clocks. This transmission is connected by General Post Office telegraph wire with Greenwich Observatory, so that the clock may be automatically corrected when necessary, thereby insuring absolutely correct Greenwich mean time.

The dials of this huge clock are to be electrically illuminated, and there is a very ingenious apparatus which automatically switches on the light at dusk, and switches it off at dawn. The times of lighting and extinguishing, however, vary with the seasons, being 4:20 P. M. in winter and 10 P. M. in summer for lighting, with an equal fluctuation in time for extinguishing.

Inasmuch as the utilization of the "waiting train" movement renders it unnecessary for the tower to be ascended to wind up the clock and correct the time, an ingenious arrangement has been incorporated which obviates the necessity to ascend the tower to adjust the lighting and extinguishing mechanism for a certain period, at the expiry of which further adjustment would have been required. There is a novel cam, mounted within the switching apparatus, by means of which the switching on and off of the electric light are altered to suit the time of year, by automatic agency. By means of a simple reducing gear, this cam is caused to make a complete revolution once in every two years. Even the error due to leap year is corrected, the compensation being so nearly complete that the error is only 10 minutes in thirty years. At the end of this period it can be corrected and set for another thirty years, in the space of one minute, and without recourse to tools.



How the great dial served as a dining table

It has been found practically impossible, according to La Revue Scientifique, by means of lighthouses either on the coast or on rocks emerging from the sea, to give all the warnings necessary to mariners for avoiding the dangers of intricate channels giving access to rivers or to ports with sandy bottoms.

Hence recourse has been had in the first place to lightships and later to luminous buoys.

The first attempts in this line were made in 1881, and in 1889 they were much extended.

The fears entertained for the stability of lights subjected to rolling in situations often dangerous were not verified.

It was found by experiment that devices could be employed which rendered the light practically inextinguishable and furnishing continuous service for months at a time. It has even been possible recently to provide them with incandescent mantles of about eight hundred hours durability and so firm of texture that their service is terminated only by exhaustion, since ruptures are exceptional.

Thanks to these, it is now possible to outline with beacons either very tortuous channels which would be difficult to mark and follow by a series of alignments on land; or passages distant from the coast when fog often obscures the observation of the alignment; or finally those shifting channels whose frequent alteration of outline may be easily denoted by a change in the position of the buoys.

One can also mark the location of isolated reefs or shoals where breakers render the construction of a lighthouse difficult or impossible.

Finally, one can indicate the dangers of a plateau strewn with boulders like that of Minquiers between Jersey and St. Malo, or of Kerkennah on the Gulf of Gabès.

Luxurious Private Car for South America

How the President of the Argentine Republic Travels at His Ease

AN unusually luxurious private car has recently been delivered to the President of the Argentine Republic by a well-known firm of Birmingham, England, and is now on exhibition at the Buenos Ayres Centennial Exposition.

In several particulars novelties of design have been incorporated in its structure, that go to improve its general appearance and also increase the available space. This is particularly true in case of the entrances, which are located in the center, the doors being set back about 18 inches from the outside faces of the car, and the sides of the body being curved in to meet them, while the roof is taken straight through and forms a canopy over the steps. Another attractive feature is the rounding of the ends and the location of the windows on the corners, permitting exceptionally broad views from the observation room.

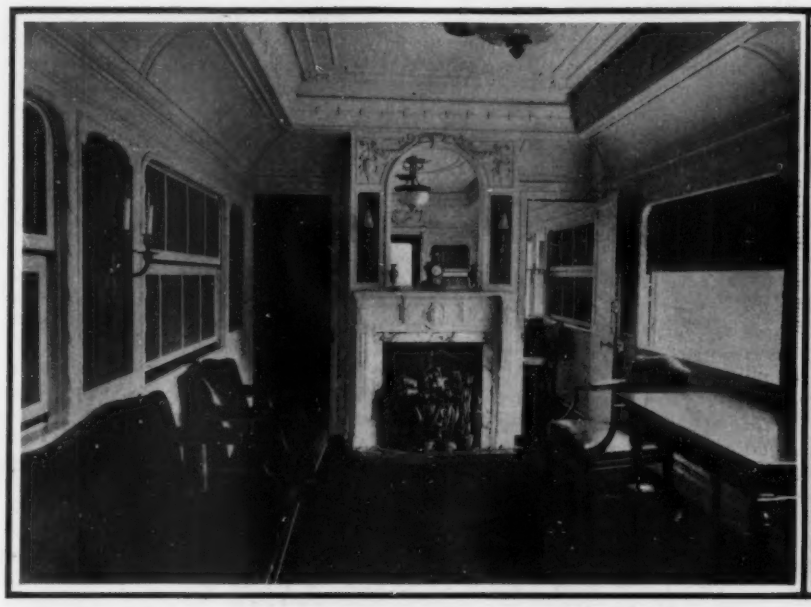
Unusual space has been provided for sleeping accommodations, as is shown in the bedroom of the President, which measures 7 feet 3 inches by 12 feet 6 inches and is adjoined by a bathroom 6 feet by 7 feet in size. The car measures 78 feet in length and has a width of 10 feet 6 inches. It is carried on two six-wheel steel trucks, special attention being given to easy riding qualities.

It is really to the interior and exterior finish of the car that special attention must be called, and in this particular it excels anything that has ever been placed on exhibition. The King of England sent, on his behalf, Viscount Churchill to personally inspect this masterpiece in railway coach construction.

An observation room of ample proportions is at one end of the car, decorated in Louis XVI. style. There is also a comfortable library, three bedrooms and bathrooms, *en suite*, and servants' quarters. The observation room, which is finished in hand-carved mahogany, painted white, and paneled with green silk, includes a fireplace with marble hearth and fittings. The furniture in this section of the car is of the finest Spanish mahogany, all upholstered in dark green leather. The floor covering is also of green color.

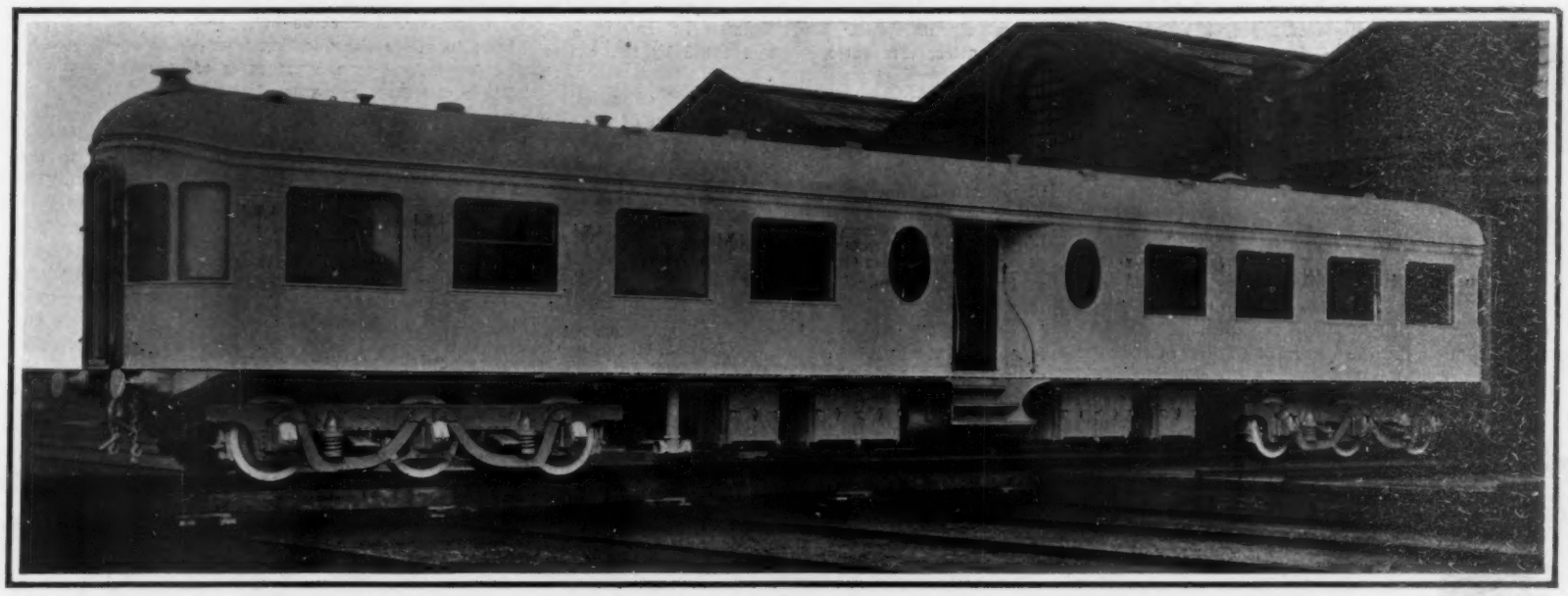
One of our illustrations shows a part of this room, and another the bathroom adjoining the bedroom of the President. In all these the most artistic electric light fixtures are installed, and they have a particularly pleasing arrangement of the ceilings. The panels of the sleeping room of this section are of dark blue with carpet to match. In the bathroom the walls and doors are paneled up to the window sills in marble, and the fixtures are all nickel throughout. The library is done in red.

On the exterior the car is sheathed with steel and painted an ivory white with decorations of blue and gold. The window frames are of polished brass, and the underframes and trucks are painted a light gray. The car is electrically lighted, current being furnished by two axle generators.



The observation room; view looking forward, showing the open fireplace

The bathroom, finished in marble, contains a shower bath



Built of steel, this car is 78 feet in length and 10 feet 6 inches in width. Note the center door recessed into the car

THE LUXURIOUS PRIVATE CAR FOR THE PRESIDENT OF THE ARGENTINE REPUBLIC

The Paris Electric Plant

SOME additional points have been added to the two large electric plants which are to be erected for the future supply of Paris. It will be remembered that the building of these stations was stipulated as one of the conditions of the contract passed between the city and the new lighting company known as the "Compagnie Parisienne." The two electric plants will be among the largest in Europe, and are laid out to use steam turbines for the principal electric groups. This was decided upon owing to the great success which was obtained from the use of the steam turbines in the St. Denis plant. One of the new stations will lie in the northern suburbs at St. Ouen, and the second in the southern suburbs at Issy. Work will be commenced very shortly upon these plants, and orders have been already placed for the steam turbine groups. These are composed of a steam turbine working with a surface condenser and coupled direct to a two-phase alternator of 10,000 kilowatts. The alternators deliver current at 12,300 volts and 42 cycles and run at 1,250 revolutions per minute. On the same shaft are mounted two smaller direct current generators, one of which serves to excite the alternator and the other to give the current for the two condenser motors. There will be used ten steam turbine groups in the north station and seven in the south station, and it is stated that five of the total number of turbines are of the Brown-Boveri type. The five corresponding groups will be built at the Jeumont and the Fiveshille works in France. The steam consumption of these turbines which work on superheated steam at 300 deg. C. (572 deg. F.), and at a pressure of 13 atmospheres, is given as 33 kilogrammes (73 pounds) per indicated horse-power, using cooling water at 15 deg. C. (59 deg. F.). Each turbine group complete weighs about 805 (long) tons, and the turbine alone represents 130 tons. The alternator figures for 70 tons and the surface condenser for 61 tons. The total length of the group is 17.30 meters (57 feet) counting the turbine itself for 9.10 meters (29) feet.

To Attach Paper Labels to Iron.—Rub the iron at the desired spot thoroughly with an onion cut in half, and then stick the label, previously smeared with paste, gum or glue, to the spot.

Variations in Saturn's Rings

By Prof. Frederic R. Honey, Trinity College

THE marvelous ring system of Saturn renders this distant planet one of unrivaled interest as a telescopic object, because of the baffling mystery as to the constituent elements of the luminous bands which move in harmony with the revolution of their primary. The theory of rigidity having long since been discarded as untenable, the assumption that they are meteoric swarms is accepted as a working hypothesis in any study of the Saturnian system. The

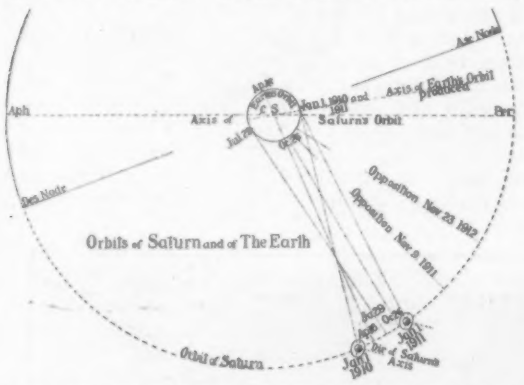


Fig. 1.—Plot showing difference between Saturn's distance from the Earth at perihelion as compared with that at aphelion.

past and the future history of Saturn's rings suggest many interesting and pertinent inquiries, e. g.: How did the rings assume their present form? What has been their change in character during the centuries? And, finally, what is the probable future of these mysterious meteoric swarms?

Saturn is now in the most interesting quarter of his orbit; and as the planet is in the northern heavens, it is seen to the best advantage in northern latitudes as evening star. At this time Saturn is approaching perihelion and steadily nearing the Earth, which will be apparent on an inspection of the plot. The center of the orbit is at c, which is nearly fifty million miles from the Sun, and the great difference between the planet's distance from the Earth at perihelion as compared with that at aphelion, is apparent even in as small a space as the plot here illustrated. At perihelion the apparent diameters of Saturn and of the rings are one and one-eighth larger than at aphelion, and as the plane of Saturn's orbit is inclined at an angle of nearly 2½ degrees to that of the Ecliptic, it will be seen from the illustration that Saturn is now not far from his maximum distance below that plane.

Variations in the apparent form and dimensions of Saturn's rings are dependent upon two conditions: the position of the planet in its orbit and that of the Earth in its orbit. During the year the apparent diameters of the rings, and also the proportion between the major and minor axes of the ellipses, change perceptibly. This is due to the changing direction of the line of vision shown in the plot of the orbits of Saturn and of the Earth. The positions of the planets are shown at the dates of conjunction, April 16th; of quadrature, July 29th; of opposition, October 26th, and also for January 1st, 1910 and 1911. The plane of the rings moves into parallel position, and at intervals of about fifteen years, when this plane passes through the Earth, an edge view is obtained, and the rings appear as a straight line. The last time this occurred was in 1907. Between seven and eight years after this date the rings will open to their greatest apparent width, and will thus be in the most favorable position for observation.

Figs. 2-6.—The appearance of Saturn during 1910, 1911, and 1912.

Figs. 2 to 6 are drawn to the same scale. If the Sun were out of the way, Fig. 2 shows what would be the apparent form and diameter of the planet and the rings at the date of conjunction, when Saturn reaches his greatest distance from the Earth in 1910. At quadrature (Fig. 3), when Saturn is nearer the Earth, the apparent diameters of the planet and the rings are increased, and also the proportion between the length of the minor axis to that of the major axis. This is due to the peculiar position of the Earth relative to Saturn at this date, as shown by the dotted line. Fig. 4 shows the planet and rings at opposition when the Earth's distance from Saturn is diminished by the diameter of the Earth's orbit, as compared with the position of the planets at conjunction. Similar changes occur each year, as the Earth occupies different positions in its orbit; but in order to compare the changes in the axes of the ellipses from year to year it is desirable to represent them at the dates of opposition, which occur on the average thirteen days later each year. The plot shows the positions of the planets at the dates of future opposition, viz., November 9th, 1911, and November 23rd, 1912.

Figs. 5 and 6 show the widening of the rings, or the proportionate increase of the minor to the major axis of the ellipse. The positions of these axes obviously vary with the latitude of the observer, and are therefore not indicated in the drawing.

The Squaring of the Circle

By J. F. Springer

THERE are certain infatuations which seem never to die. One of the hardiest of these concerns perpetual motion. There are probably quite a number of men in the United States to-day industriously working at this impossible problem of getting something from nothing. It is possible that they never can be convinced that another cog-wheel here or counter-weight there will be ineffectual in reversing the principle that an effect must have a competent cause. Another and perhaps (if that be possible) more immortal infatuation concerns the squaring of the circle. An intelligent (even though not exhaustive) apprehension of the real character of the problem and what has been accomplished is perhaps the very best method of perceiving the futility of seeking to square the circle by mechanical means or by the processes of Euclidean geometry.

Strictly speaking, the problem of the quadrature of the circle is concerned with the determination of a square whose area shall be equal to that of a given circle. However, the ancient Greeks were aware that the area of a circle is equal to one-fourth the rectangle whose sides are the circumference and the diameter. Consequently, if the circumference of the particular circle could be found, it would easily be possible to complete the solution of the problem. Further, they also knew that the ratio between the circumference and the diameter is invariable whatever be the diameter of the circle. The circumference in any particular case would then be readily obtainable if one knew this invariable ratio. The result of these circumstances is that the problem of the quadrature of the circle reduces itself to that of the rectification of the circumference, and this in turn to the determination of the constant ratio between circumference and diameter. In modern mathematics, this ratio is represented by the Greek letter π.

What was, perhaps, the greatest mind of antiquity attacked the problem of the determination of π. His general method of procedure sufficed in his hands to produce a good approximation and has been effective in modern times of yielding results accurate beyond all present or future needs. In fact, the value obtained by Archimedes considerably more than 2,000 years ago is better, probably, than the figures arrived at by most of the modern "circle squarers." He determined that π lay between 3 10/71 and 3 1/7; that is, between 3.140845 + and 3.142857 +. The true value is approximately 3.141593. A result, which was probably obtained by Archimedes' method, was given by Ptolemy in the second century of our era. It was 3.141552. This shows a very close approach to the truth.

It will be instructive to set forth the essentials of the Archimedean method. Conceive—Fig. 1—the circle to be inscribed and also circumscribed by a regular hexagon. Assuming, as well we may, that the perimeter of the circumscribed polygon is greater than the circumference and that the perimeter of the inscribed is less, we easily see that if we calculate the ratios of these two perimeters to the diameter we shall in the one case have a ratio greater than π and in the other a less ratio. Consequently, the value of π lies between the two. Now Archimedes was able to calculate not only the perimeter of the circumscribed hexagon, but of the regular figures having 12, 24, 48, and 96 sides. He found the ratio of the perimeter of the 96-gon to the diameter of the circle to be 3 1/7. By a similar process of passing from the regular inscribed hexagon to the polygon of double the number of sides, and so on to the regular inscribed polygon of 96 sides. The perimeter of this he found to bear the ratio of 3 10/71 to the diameter.

There seems to have been no advance made, except perhaps in accuracy, until modern times, when trigonometry and the calculus have yielded other methods. But the polygon method has afforded—although at the expense of prodigious calculations—results of incredible accuracy. One of the most indefatigable of all the calculators was Ludolph van Ceulen (died 1610). The result of his most thorough-going investigation was inscribed upon his tombstone in St. Peter's Church, Leyden. He found by the polygon method (36,893,488,147,419,103,232 sides) that

$$\pi > 3.14159265358979323846264338327950288$$
$$\pi < 3.14159265358979323846264338327950289$$

Now let it be observed that these numbers agree except in the last figure. Consequently, π, which lies between them, is correctly represented in 34 decimal places. Right here is the place for all those "circle squarers" to stop, who get results different from this. One of these values is greater than π, the other is less, and both agree for 34 decimal places. *For these 34 places*, then, the result is *absolutely correct* and is *not susceptible of improvement*. It is absurd to suppose that a different result, also correct, could be obtained by other means. Mathematics does not contradict itself.

Now the value of π just given enables calculations to be made with a wonderful degree of precision. Montucla, the great historian of mathematics, has estimated in effect that if a circle be described with the enormous radius of 250,000 times our distance from the sun, the variation from the truth of the circumference calculated by means of this value of π would be so small as not only to be invisible to our vision, but to be beyond the power of our best microscopes or any that will conceivably be invented in the future. It may be judged from this that mathematicians are in no need of a more accurate determination. But if they were in such need, the evaluation of π has been carried much further since the death of Ludolph in 1610. In fact, one computer has calculated the value to about 500 decimal places. This result has been confirmed. Another computer has carried the determination to 700 places, but his result, so far as I am informed, has not been checked. Some "circle squarers," it would appear, labored under the delusion that there was scientific interest in a close determination in order to calculate with precision the longitude at sea. This is a mirage. The value of π known to Ptolemy nearly eighteen hundred years ago is amply sufficient for all practical purposes. It is entirely unnecessary to use the closer approximations of modern times. Ancient history is quite good enough.

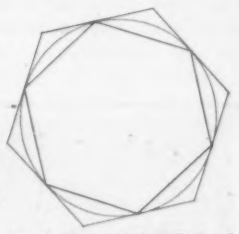


Fig. 1.—The circle inscribed and also circumscribed by a regular hexagon.

What mathematicians have been interested in, has been to settle the question whether π could possibly be determined by the processes of ordinary geometry. These processes recognize but two mechanical instruments—ruler and compasses. This matter has been in agitation for a long while, but seems to have been conclusively set at rest by Prof. Lindemann in 1882 by his demonstration that ruler and compasses (i e., straight line and circle) are insufficient.

It seems that many "circle squarers" have been under the impression that a large government reward had been offered for a correct solution. Thus, an agricultural laborer who had devised what he imagined was a solution came to London and there submitted it to Prof. de Morgan, who was then occupying a chair in mathematics at University College. Accompanying the alleged solution was a copy of a letter in which demand was made upon the Lord Chancellor for a supposed prize £100,000 ($485,000). Prof. de Morgan was unable to regard the mathematical effort as successful. In returning the papers he remarked that he did not think the author possessed the knowledge requisite to an understanding of the problem. This was replied to by the not very amiable remark that Prof. de Morgan should "change his business and appropriate his time and attention to a Sunday School to Learn what he Could, and Keep the Little Children from durting their Close."

Fig. 2.—The area of the circle as found between the limits of the 4 and the 8 triangles of the 2 squares.

But this man is by no means the only uneducated person on record as having attacked this problem. About 1836 a certain well digger in France who could neither read nor write had need to know how much stone would be required to pave the circular bottom of a reservoir which he had constructed. Consulting a "mathematician" relative to this point, he was astonished to learn that mathematical science was unable to determine the amount with precision, the ratio of the circumference to the diameter constituting a problem still unsolved. This answer was entirely unwarranted by the facts. It was true—

and is still true—that no one had succeeded in stating the ratio without using square-roots (or other roots) which could not be fully determined. But Ludolph van Ceulen's approximation to 34 decimal places had been in existence for more than two centuries. Supposing the reservoir to be absolutely circular, the amount of material could have been calculated so closely that the piece of stone representing the error would have been much too small to affect the digestion of the smallest bacillus known to the microscope. In fact, it would have been regarded as an infinitely small quantity in the mathematics of such bacilli. However, Lacomme—for that was the well digger's name—was profoundly impressed. Regarding the matter as within the possibilities of his own efforts, he gallantly attacked this problem of the ages and originated a mechanical solution—or, at least, what he thought was a solution. How worthless any mechanical method would be, from a practical point of view, even to-day may be seen from the fact that probably the very utmost accuracy of our best micrometer measurements is only to 0.000001 of an inch. So that even if, for instance, we roll a perfectly round disk on a perfect plane in a perfect line until we have accomplished one perfect revolution and thus determine a straight line equal to the circumference, how are we to measure this line? However, Lacomme applied himself to reading, writing, and arithmetic and satisfied himself arithmetically as to his "solution." His efforts to get the attention of learned societies culminated at last in the appointment of a committee of investigation by a certain Society of Arts and Sciences in Paris. This organization voted him a silver medal of the first class. This recognition was followed by the award of three other medals by various societies. All this sounds well-nigh incredible, but Prof. de Morgan, who attempted to investigate the matter, regarded the awards of the medals as possible, but was unwilling to concede that the societies were probably of high standing. The French Academy had passed a resolution three-quarters of a century before to have done with all circle-squaring propositions.

But it was not merely England and France that were able to produce "circle squarers." In 1840 there was publisned in Hamburg a confused and complicated treatise on this problem. The author regarded himself as entirely successful, as the following language quoted by Prof. Schubert implies: "And thus it has pleased our mother Nature to withhold this precious mathematical jewel from the eye of human investigation, until she thought it fitting to reveal truth to simplicity." His "solution" would seem—as deciphered by Prof. Schubert—to be as follows: The circle in Fig. 2 is larger than the inscribed square and smaller than the circumscribed one. Now the smaller square consists of four triangles and the larger of eight, the triangles being all equal. Consequently, the area of the circle is to be found between the two limits. This "solver" put it at six triangles, that is three-fourths of the larger square. This would yield 3 for the value of π—a result that a string and a dinner-plate would have corrected.

One of the most learned men of all time was Joseph Scaliger. But his learning—in the acquisitive branches—did not prevent him from becoming affected with the infatuation of squaring the circle. In 1592 he published a "solution" in a work entitled *Nova Cyclometrica* (A New Science of Circle Measuring). This was refuted by one or more of the mathematicians of the time. Scaliger is said to have maintained the doctrine that an arc is less than its chord in arithmetic, but greater in geometry. This proposition he describes as a "noble paradox." He seems to have regarded arithmetic as a kind of Land of the Fourth Dimension where any silly thing might be true.

Cardinal de Cusa, who lived in the fifteenth century, gave a most curious geometrical "solution." In the given circle he inscribed a square. He then used a side of this as a radius. In the resulting circle he inscribed an equilateral triangle, whose perimeter he maintained was equal to the circumference of the original circle. He was refuted by Regio Montanus.

But this does not exhaust the list of the eminent "squarers." Thomas Hobbes, accounted one of England's great philosophers, thought he had discovered a geometrical solution. Having attacked Oxford University, he was told in reply that his mathematical productions would probably be more thoroughly understood at the university than would be pleasant for their author. Hobbes published his "solution," which was demolished by Wallis. But the philosopher never gave up the problem. He seems to have been quite arrogant in the discussion, for one of his publications was entitled, "Six Lessons for the Professors of Mathematics, One of Geometry, the Other of Astronomy, in the University of Oxford." Wallis's reply was styled "Due Correction for Mr. Hobbes; or, School Discipline for Not Saying His Lessons Right."

The Loss of Aviator Grace

The fears expressed in our last issue as to the fate of Mr. Cecil Grace were well founded. He was seen by some coast guardsmen over Goodwin Sands about five miles out at sea some fifty minutes after he left France. Although at first heading for the English shore, he suddenly turned and went off in a northeast direction. It is thought that he mistook the cliffs for fog banks, steered away from the shore, and was lost in the North Sea. He was flying a Short-Wright biplane, which is a modified Wright machine of the same sort as that in which he first learned to fly and in which, last June, he made the first flight in England to be made over warships. On this occasion he also flew from Eastchurch, on the Isle of Sheppey, passing over Minster and Sheerness and circling above the warships "Victorious" and "Bulwark" at a height of 500 feet. On December 22nd, when he left France, Mr. Grace is said to have carried enough fuel for a five-hour flight. At first there was a report that his aeroplane had been found near an island off the coast of Holland, but this was not true. The captain of a Channel steamer also reported passing wreckage that resembled an aeroplane; but at the present writing no authentic traces of man or machine have been found. This makes the second airman that the North Sea has swallowed of late, as only a few weeks ago one of three balloonists was lost overboard when the basket of the balloon struck the water in a fast flight from Germany to England in an aerostat. Mr. Grace was another aviator like Rolls, whom both the science and sport of aviation can ill afford to lose.

New Records at the Los Angeles Aviation Meet

For the second time last year a new height record was made at an aviation meet at Los Angeles on December 26th. The new record is 11,474 feet, which is nearly a thousand feet higher than the record of Legagneux made in France on December 9th. The earlier record was made at Los Angeles by Louis Paulhan, who on January 10th, 1910, reached a height of 4,164 feet in his Farman biplane. All these height records have been made with biplanes, the latest one being made with a standard Wright machine. Mr. Hoxsey is the Wright flier who reached this height of well over two miles, and that he succeeded in accomplishing it in windy weather and in mid-winter, when the cold at this elevation is intense, speaks well of him as an aviator. His new record was made early in the third day of the meet and when there was a wind of thirty miles an hour or more blowing. He was in the air over two hours, and was so benumbed by the cold that he was able to control his machine only with the greatest difficulty. After he had risen a few thousand feet above the earth, he found fighting the wind was much easier, and that the chief thing which he had to contend with was intense cold. In the course of his flight he circled about over a wide stretch of country, and on several occasions he was over a mile out at sea. He was out of sight of the spectators for over one hour, but his machine was observed through telescopes, and his height measured by triangulation as well as by the registering barometer.

The same day that Mr. Hoxsey broke the altitude record, Hubert Latham smashed his Antoinette monoplane when alighting in the teeth of the wind. He had flown magnificently for two and a quarter hours, and only came down when his fuel supply was getting low. He had spare parts for three machines, and by working his mechanics steadily he succeeded in rebuilding his monoplane in less than forty hours, and flying again two days later. Previous to the meet, Latham tried duck shooting from his monoplane. He flew low down above a marsh and started the ducks, chasing them out over the ocean and shooting at them a number of times. He succeeded in bringing down several. On Christmas day, which was the second day of the meet, Latham remained aloft all told over three hours. He made two flights of one hour and forty minutes and one hour and twenty-five minutes respectively. Latham and Willard competed in the bomb-dropping contest, and both did equally well in dropping bombs upon the diagram representing a warship. Archie Hoxsey rose to a height of 9,288 feet the first day of the meet, while he reached 7,922 the second day. The third day he made his new record, and the fourth day he reached the height of 6,800 feet. On the fourth day, December 28th, a Curtiss machine driven by Ely beat a Wright biplane driven by Parmalee by half a lap in a five-lap race. The time was 10:05 3/5 for a distance of 8¾ miles. Besides this race there was another held the following day between James Radley, the English speed champion, on his Blériot, Ely on his Curtiss, and Parmalee on a "baby" Wright. This event was flown through a distance of 8¾ miles, and was won by Mr. Radley in 9:13 1/5—an average speed of about 48 miles an hour. His fastest lap was made at a higher rate. Hoxsey made a cross-country flight to Mt. Wilson, some 35 miles distant. He was gone about two hours, and reached an altitude of 8,200 feet. Radley also made several cross-country flights, going to Long Beach and back in one of them. Parmalee did some fast turns with his "baby" Wright, and Walter Brookins, besides carrying a passenger, made his celebrated spiral dive from a height of 2,000 feet. Glenn H. Curtiss prepared his new racer, with which he expected to make a demonstration before the close of the meet.

Mr. William W. Holt

Mr. William W. Holt, one of the patent attorneys of the force of the New York office of Munn and Company, died on the 27th ultimo at Manassas, Va.

Mr. Holt was a native of North Carolina, having been born at Burlington on February 27th, 1876. He graduated from the Manchester-Virginia High School at the age of sixteen and continued his education at the Virginia Military Institute, taking the full course in civil and mechanical engineering.

After graduation, he entered the employ of the Southern Railway Company as assistant engineer and draftsman, but resigned from the service in 1899 to accept a position as machinist in the Navy Yard at Washington, D. C. Here he gained that practical shop experience which was to be of so much benefit to him in his subsequent career as a patent attorney. On April 25th, 1902, he was appointed an assistant examiner in the U. S. Patent Office. Here he remained for nearly four years. On April 1st, 1906, he resigned to enter the service of Munn & Company.

Mr. Holt was admirably equipped for his work as a patent attorney. He brought to his profession the technical education, practical shop training, and the Patent Office experience which eminently fitted him for the work of a patent solicitor.

He had a fine, well-ordered mind, a wonderful capacity for work, and an earnestness, and a wholesome sincerity and honesty which impressed all who came in contact with him. His genial personality will be missed by those who knew him.

Preserve Your Papers; They are of Permanent Value

By taking a little trouble, when a paper first comes to hand, it may be preserved to form a permanent and valuable addition to the reading matter with which everyone should be supplied. We furnish a neat and attractive cloth board binder, which will be sent by mail, prepaid, for $1.50. It has good strong covers, on which the name SCIENTIFIC AMERICAN or SCIENTIFIC AMERICAN SUPPLEMENT is stamped in gold, and means by which the numbers may be securely held as in a bound book. One binder may thus be made serviceable for several years, and when the successive volumes, as they are completed, are bound in permanent form, the subscriber ultimately finds himself, for a moderate cost, in possession of a most valuable addition to any library, embracing a wide variety of scientific and general information, and timely and original illustrations. Save your papers.

The Current Supplement

A London newspaper has installed machinery for making its own paper. That interesting plant is described in the opening of the current SUPPLEMENT, No. 1827.—An interesting summary of Prof. Dalby's British Association paper is presented, or rather of that phase of it in which he calculates locomotive power in terms of tons of total load, including engine and tender, speed, and train resistance.—An excellent review of the progress made in aviation in 1910 is presented by Réne Gasnier.—Dr. William Eichholtz points out the limits of our chemical knowledge.—The results attained by the Metropolitan Museum of Art's Egyptian Expedition are presented by Mr. H. E. Winlock.—Mr. Owen Ely traces the origin and development of the conception of ether.—The question, "Do fishes hear?" is answered by Dr. William Roth in a summary of "Interesting Recent Biological Investigations."

A $20,000 Prize for Inventors

The Paris daily journals announce that a prize of $20,000 has been offered by a person whose name remains unknown, for a life-saving device to be applied to submarines. It is to allow the crew to leave the submarine, and mount to the surface and keep afloat. The matter is placed in the hands of the Minister of the Marine, who is to open a contest for such devices. Only French subjects can compete for the prize. This will be awarded should the device be approved by the Council of the Marine.

Prof. Albert Abraham Michelson

The New President of the American Association for the Advancement of Science

By Marcus Benjamin, Ph.D.

ACHIEVEMENT in science has usually been promptly recognized and generously rewarded in this country. Among the honors that are gladly accorded to those who have been successful in attaining eminence in science, is the presidency of the American Association for the Advancement of Science. An election to that high office has come to be regarded as public recognition of attainments of the person so chosen. The practice of alternating a student of one of the physical sciences with a representative of one of the natural sciences is an excellent one, and its wisdom was demonstrated at the last meeting of that organization, when Albert A. Michelson, easily the foremost physicist in this country, was chosen to succeed so prominent a naturalist as David Starr Jordan.

Prof. Michelson was born in Strelno, Prussian Poland, on December 19th, 1852, but as a boy came to the United States, settling with his parents in San Francisco, Cal., where he received his early education, studying in the public schools and then graduating from the High School. An appointment from President Grant to the U. S. Naval Academy followed, and he was graduated as midshipman in 1873. After nearly two years' sea service he returned to the Academy as instructor in the department of physics and chemistry, and then for about a year served in Washington in the office of the Nautical Almanac.

Yielding to his fondness for research, he resigned from the U. S. Navy in 1881, and studied for two years in Europe at the universities of Berlin and Heidelberg under Helmholtz and Quincke, and then at the Collège de France and Ecole Polytechnique in Paris under Cornu, Mascart, and Lippman. In 1883 he returned to the United States and entered on the active duties of the professorship of physics in the Case School of Applied Science in Cleveland, Ohio, to which he had been called, and remained there for six years. In 1889 he resigned from that appointment to accept the chair of physics in Clark University, Worcester, Mass. Three years later he was called to the University of Chicago, then recently reorganized, and was made professor and head of the department of physics, which place he has since held.

While on duty in the department of physics in the U. S. Naval Academy, he developed a fondness for investigating problems in physics which culminated in his determination of the velocity of light to be 186,305 miles a second, an achievement which immediately gained for him recognition as a brilliant investigator. He continued his researches in that branch of physics, and during the winter of 1880 devised a method for testing the relative motion of the earth and the ether, which resulted in the invention of the interferometer. An important investigation of his made in connection with his colleague at the Case School, Prof. E. W. Morley, was the study of the application of interference methods to astronomical and spectroscopic measurements. The former resulted in a device by means of which the diameters of Jupiter's satellites were measured at the Lick Observatory, while the latter showed that, of the many radiations examined, nearly all were more or less complex. Among the more simple, one was found which promised to fulfill conditions necessary for a standard of length, namely, the red radiation from cadmium vapor made luminous by the electric discharge. This resulted later in an invitation to demonstrate his work before the International Committee on Weights and Measures at Sêvres, France. His results were so convincing that his method was adopted as a standard. More recently he has devoted his attention to the analysis of spectral radiations and the effects thereon of temperature, pressure, and of magnetism; and in the invention and construction of apparatus designed with a view to increasing the power and efficiency of spectroscopic appliances. Among these may be mentioned the echelon, which has a resolving power ten times as great as the largest diffraction grating, and a ruling engine capable of the most minute ruling.

In honors Prof. Michelson ranks highest among American men of science. Western Reserve gave him the degree of Ph. D. in 1886, and Stevens Institute of Technology conferred a similar honor upon him in 1887. Cambridge in England bestowed upon him the degree of Sc.D. in 1899, and Yale in 1901, and Pennsylvania in 1906 conferred upon him the degree of LL.D., while Clark in 1909 gave him the unusual but most appropriate degree of D.Phys. He was awarded the gold Rumford medals of the American Academy of Arts and Sciences in 1889, and in 1904 he received the Mattencci medal of the Societa Italiana of Rome. The Copley medal, the highest distinction of the Royal Society of London, was conferred upon him in 1907, and in the same year the Nobel prize in physics of $40,000 was given to him, "to signalize as worthy of especial honor the eminently successful researches you have carried out." He is the only American who has thus far received a Nobel prize in science.

In 1899 he delivered the course of Lowell lectures in Boston, and he has represented the United States on the International Committee of Weights and Measures since 1900. Also in 1900 he received a *grand prix* at the exposition held in Paris during that year, in recognition of his scientific researches.

PROF. A. A. MICHELSON

President of the American Association for the Advancement of Science

Prof. Michelson is a member of many scientific societies. In the United States he was elected an associate fellow of the American Academy of Arts and Sciences in 1885; a fellow of the American Philosophical Society in 1902; a member of the National Academy of Sciences in 1888; and besides membership in many other societies, in 1900 he was elected president of the American Physical Society. His recognition abroad has been equally distinguished. In 1885 he was made a corresponding member of the British Association for the Advancement of Science; in 1896 a fellow of the Royal Astronomical Society, and in 1906 a corresponding fellow of the Royal Society of London. He also holds honorary connections with many other European societies, including the French Academy of Sciences (1900), the Vetenskaps Akademien in Stockholm (1906), and the Reale Accademia dei Lincei in Rome (1906).

His connection with the American Association for the Advancement of Science began with his election to membership at the Nashville meeting in 1877. Two years later he was advanced to the grade of fellow. In 1887 he was chosen a vice-president of the association, and delivered a retiring address before the Section on Physics in 1888, entitled "A Plea for Light Waves," in which he presented with great discernment the many possible applications of the interferometer. At the Boston meeting in January last came his culminating relation to the association by his election to the presidency, an honor appropriately conferred upon him, who since the death of Simon Newcomb easily succeeds to the distinction of being the greatest man of science now living in the United States.

Uncle Sam's Mine Rescue Cars

By M. M. Hunting

The appalling loss of life in American coal mines the past year has moved the Bureau of Mines to take active steps in the preparation of adequate appliances for rescue work and the training of men in their use. That the number of deaths in American mines, both coal and metal, during the year 1909 should be about 5 out of every 1,000 employed, and that of European countries only about 2 out of every 1,000, has caused inquiry; and it has been found that this astounding difference is largely due to the fact that for some time past these European countries have maintained efficient rescue stations.

With the hope that this happy condition may be duplicated in our own country, the Bureau of Mines has recently equipped six cars with the latest apparatus for rescue work, including also first-aid materials, and has manned them with experienced miners trained to this work.

These rescue cars are stationed at the great coal-mining centers, and will be sent out at a moment's notice to the scene of a disaster to co-operate with the State mining officials in rescuing entombed miners. Besides this emergency feature, the cars will visit all mining towns and camps of any importance within their alloted territory, giving free instruction to the men in the saving of life and the proper care of the injured.

A surgeon from the American Red Cross Society and a mining engineer are members of the crew of each car, and will deliver lectures upon the use of explosives, electrical apparatus, fire prevention, sanitation, etc. These lectures will be given in the cars when other suitable meeting places are not available. The car will remain long enough at each place so that every miner may have an opportunity to learn the work of rescue, under the instruction of the foreman of the car, a practical miner. The men will also be encouraged to form rescue brigades at the mines where they are employed, requesting the operators to equip them with necessary apparatus.

Each car will contain eight so-called oxygen helmets, a supply of oxygen in tanks, twelve safety lamps, and a field telephone with 2,600 feet of wire, resuscitating outfits, etc.

One end of the car is fitted with an airtight room in which the training of men in the use of the oxygen helmet is carried on. This room is filled with noxious gases, and miners wearing the oxygen helmets will be required to enter and remain for two hours. These helmets permit the wearer to enter a mine immediately after an explosion, while the atmosphere still reeks with poisonous gases, subsisting meanwhile upon the oxygen from the tank.

Had these helmets been available at some of the recent mine disasters, it is believed that many lives might have been saved. It is not infrequently the case that miners are only slightly injured by explosions, but perish because of the poisonous air they are compelled to breathe while help is coming to them. At the recent Cherry mine disaster, the oxygen helmet proved of inestimable value in the rescue of twenty men who were entombed seven days.

The six cars will be stationed at the following points: Rock Springs, Wyo.; Billings, Mont.; Salt Lake City, Utah; Urbana, Ill.; Knoxville, Tenn., and Pittsburg, Pa.

To Bleach Ivory.—Lay it in a glass dish filled with turpentine and expose it, for three to four days, to the sunlight.

The Heavens in January

By Henry Norris Russell, Ph.D.

IN modern methods of scientific research rather curious situations sometimes arise, as is illustrated by a recent case, when an astronomer sent in a requisition for the purchase of "two thousand pounds of ice, for use in astronomical observations." What the ice was used for, and how successful were the results, is told in a recent paper by Prof. Stebbins, of the University of Illinois, who has for some years been working on the measurement of starlight with the aid of the selenium photometer.

This last phrase may seem to increase the puzzle. What has the rare element selenium to do with astronomy? Things become comprehensible when it is remembered that a thin sheet of this substance, suitably prepared, decreases in electrical resistance when light falls on it. By putting such an apparatus at the focus of a telescope, and pointing at a bright star, the amount of light received may be measured, by means of the deflections of a sensitive galvanometer.

Temperature changes affect the selenium largely; hence the use of the ice, forming a large "pack" about the case in which the selenium cell was contained, and protecting it from variations of temperature.

Having got this apparatus in efficient working order, Prof. Stebbins has made a long series of measurements on the variable star Algol, with very interesting results. The accuracy of measurement of which the new apparatus is capable is very high, so that the well-known changes in Algol's light, during the eclipse which it suffers at regular intervals, can be very accurately followed.

Continuing the observations throughout the period, it was found that, half way between successive eclipses of Algol by its invisible companion, a small but undoubted diminution of light took place — just at the time when Algol itself would eclipse the companion; showing that the latter was not wholly dark, but gave out light of its own.

The eclipse of the companion by the principal star, however, cuts off but 6 per cent of the combined light of the two; while, when the principal star is eclipsed, about 62 per cent of the combined light is obscured. The small loss of light in the former case is imperceptible to the ordinary eye, which explains why it was not previously detected, though a long series of observations with the best visual photometers (instruments for measuring the light of the stars by direct observation) would doubtless have revealed it.

Besides all this it appears that the combined light of the two stars, when no eclipse is taking place, is least when the companion is nearest us—almost, though not quite, in front of the bright star—and greatest when it is almost, though not quite, behind it. Prof. Stebbins explains this by assuming that the companion is brighter on the side toward Algol where the radiation of the bright star heats it up.

It may be remarked in passing that a similar phenomenon was detected by Prof. Dugan of Princeton in the case of a much fainter variable star of the same kind (R T Persei), and explained in the same way, two years earlier.

From the complete "light curve" showing the whole course of the variation of Algol's brightness, the brightness and dimensions of both stars can be found, taking the distance between them as the unit of measure. To find this distance in miles, we must call to our aid the spectroscope, which measures the velocity of the orbital motion of the bright star. As the faint star cannot be spectroscopically observed, some assumption concerning its mass or density is necessary. Making the assumption, which seems very plausible, that its mass is one-half that of the bright star, Dr. Stebbins arrives at the following conclusions:

The bright star is 1,250,000 miles in diameter—a little less than one and one-half times as big as the sun. Its mass is three-eighths that of the sun, and its density only one-eighth that of the latter. The fainter star is still larger, about 1,450,000 miles in diameter (or one and two-thirds times that of the sun), while its mass is but three-sixteenths, and its density only one-twenty-fifth that of the sun. The centers of the two stars are just three million miles apart, and they revolve about one another in a nearly circular orbit in 68h. 49m. The plane of the orbit is inclined about 7¾ deg. to the line joining Algol to the sun, so that the eclipse as we see it is partial, rather more than one-fourth of the diameter of the brighter star being unobscured.

The principal star is about nine times as bright as the brighter side of the companion and fifteen times as bright as the fainter side. To compare these with the sun's brightness, we need to know the distance of Algol, which is unfortunately so great as to be almost beyond the limit of measurement.

It is probable, however, that the brighter star, though of only about twice the superficial area of the sun, gives out at least fifty times as much light; while the faint companion, though long regarded as a dark body, because its light was so small a fraction of the whole, gives out at least three times as much light as the sun, even on its fainter side.

It is easy for anyone to see for himself the changes in light during the principal eclipses of Algol. During the present month, minima observable in our longitude occur at 11 P. M. (Eastern Standard Time) on January 1st, 8 P. M. on the 4th, 5 P. M. on the 7th, and so on, coming 3h. 11m. earlier on every third night till they are again conveniently observable at midnight on the 21st, 9 P. M. on the 24th, and so on.

THE HEAVENS.

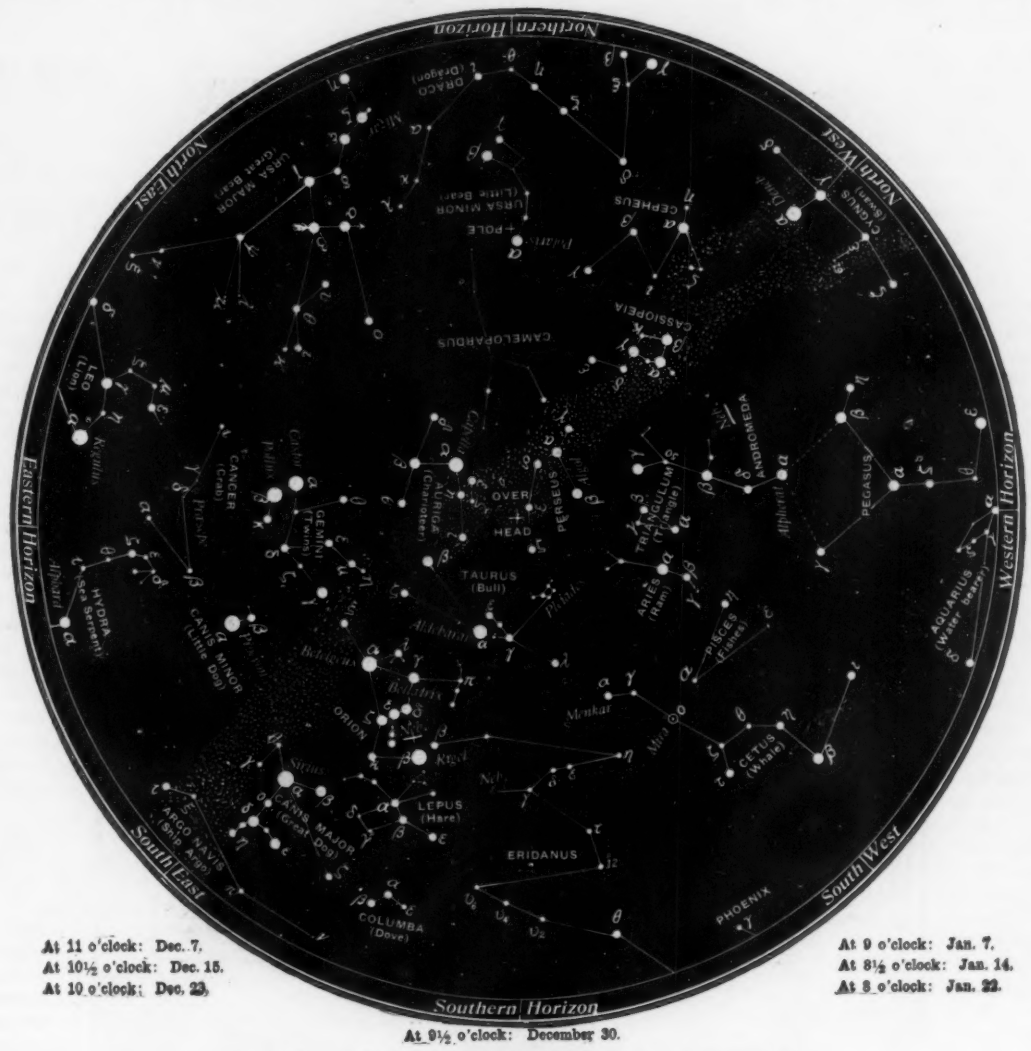
Turning to our star chart, we find the splendid group of constellations, of which Orion is the center, filling the southeastern sky. The Pleiades are almost overhead. Below them comes the larger group of the Hyades, including the red Aldebaran. Orion is next, and then Canis Major, recognizable at once by the incomparable brilliancy of Sirius.

Below Orion are two constellations which, though small, are fairly conspicuous, and are shown in our initial letter. Lepus, the Hare, is an ancient constellation, mentioned by Ptolemy. Its principal configuration is a small quadrilateral of stars of the third and fourth magnitude directly below Orion.

Columba, the Dove, which is south of this again, is a relatively modern group—being supposed to represent Noah's dove, in the biblical story of the Deluge. It contains one bright star of nearly the second magnitude, which may be found by carrying a line from Procyon through Sirius to an equal distance on the opposite side.

West of these is the huge extent of Eridanus—a winding stream of faint stars, beginning near Orion, and pursuing a zigzag course down to the southern horizon, and indeed below it, for Achernar, its brightest star, is visible only from points below the 30th parallel of north latitude.

In the eastern sky we find Gemini and Canis Minor, with Leo and Hydra rising, and Cancer, with the faint star cluster Praesepe above the latter. The Great Bear is coming up in the northeast, the Dragon and the Little Bear are low in the north, and Cassiopeia and Cepheus are in the northwest above Cygnus, which has nearly set. Auriga and Perseus are overhead, and west of them are Aries and Andromeda. Pegasus is lower down in the west, Pisces next to the southward, and finally Cetus, setting tail first.



At 11 o'clock: Dec. 7.
At 10½ o'clock: Dec. 15.
At 10 o'clock: Dec. 23.

At 9 o'clock: Jan. 7.
At 8½ o'clock: Jan. 14.
At 8 o'clock: Jan. 22.

At 9½ o'clock: December 30.

NIGHT SKY: DECEMBER AND JANUARY

THE PLANETS.

Mercury is theoretically an evening star till the 10th, when he passes through conjunction with the sun, and becomes a morning star; but he is actually so near the sun all through the month as to be almost invisible. Venus is an evening star, setting only about half an hour after the sun at the month's beginning, but remaining in sight at its close till an hour and a half after sunset. Mars is morning star in Scorpio, rising about 5 A. M. He is over 200 million miles away from us, and so does not appear very bright. Jupiter is likewise a morning star, but rises much earlier—a little before 2 A. M. on the 15th. Saturn is the only one of the planets visible in the evening sky. He is a conspicuous object on the border of Pisces and Aries, and remains visible till a little after midnight. On the 20th he is in quadrature with the sun, and is due south at 6 P. M. Uranus is in conjunction with the sun on the 16th, and is invisible this month. Neptune is in the very opposite quarter of the sky—being in opposition on the 11th—and is visible all night long. His position on the 15th is R. A. 7h. 26m. 26s., Dec. + 21 deg. 18 min. 40 sec., and his daily motions —7s. in R. A. and + 15 sec. in declination.

The moon is in her first quarter at 1 A. M. on the 8th, full at 5 P. M. on the 14th, in her last quarter at 1 A. M. on the 22d, and new at 5 A. M. on the 30th. She is nearest us on the 12th, and farthest off on the 24th. In her circuit of the sky she passes near Venus, Uranus, and Mercury on the 1st, Saturn on the 8th, Neptune on the 14th, Jupiter on the 23rd, Mars on the 26th, Mercury again on the 28th, and Uranus on the 29th.

Abstracts from Current Scientific Periodicals

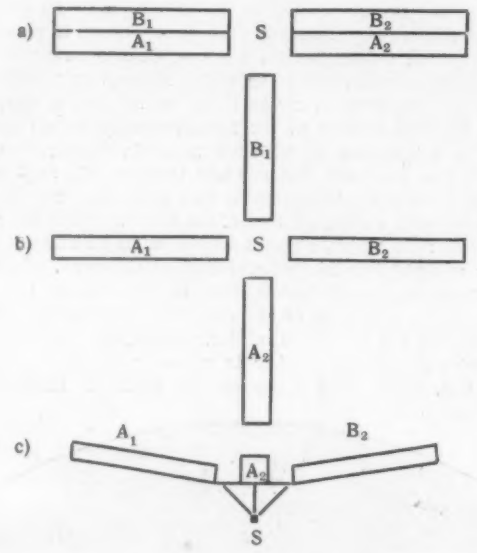
In this department of the Scientific American, the reader will find brief abstracts from interesting articles published in English scientific periodicals, and translations of valuable articles that appear in French, German, and other European scientific publications. The department, in other words, will be a kind of digest of current scientific information gleaned from reputable sources.

A Safety Device for Air Craft

IT is self-evident that the problem of aerial travel cannot be solved simply by the construction of vessels capable of carrying persons through the air at great altitudes, but that it is equally important to bring the aeronauts back to earth without injury. For, what does it profit an aeronaut, or his successors, to accumulate valuable experience if at the end of his flight he is dashed to the ground and killed? So questions Prof. L. Zehnder in Umschau, and proceeds to answer himself thus: "In view of the numerous fatal accidents that have occurred in the last few weeks, I think that it would be well to offer prizes for types of construction and equipment that would minimize the danger of fatal falls, and to prohibit the carrying of passengers in aerial vessels of any other sort.

"Every aeroplane should be so constructed that the pilot could instantly and easily transform it into a parachute, which, however, need not have the conventional parachute form. In the case of a monoplane, for example, the wing on each side might consist of a front half, B_1 or B_2, and a rear half, A_1 or A_2 (see Fig. *a* of the diagram). In flight these half wings would be coupled together so that each wing would form a single sustaining surface, but in case of accident the four half wings could, by a single movement of the pilot, be arranged in the form of a cross, as in Fig. *b*. (The sustaining surfaces of aeroplanes would be more efficient, for a given weight, if they were made of stiff sheet metal, instead of flexible canvas, which, if not perfectly taut, assumes forms which greatly increase the resistance to progression.) The change might be effected automatically by the pilot rising to his feet. The stability of the parachute thus formed would be increased by inclining the four surfaces so that their outer ends are higher than their inner ends, as in Fig. *c*, where *S* denotes the center of gravity of the machine, motor and pilot. This arrangement would make capsizing impossible.

"By experiments with weighted models it would not be difficult to find a form of supporting surface and a type of construction such that the aeroplane, in falling from any flying position, would automatically assume this stable falling position. The surfaces must be large enough to bring the aviator to the ground unharmed, and the machine should be provided with elastic feet, to diminish the shock of landing. It is possible, also, to attach the motor and other heavy machinery to the aeroplane in such a manner that they could be cast loose and dropped before the ground is reached, enabling the light aeroplane-parachute, weighted only by the pilot, to sink gently to earth, still guided by its steering and elevating rudders.



a. Plan of monoplane with divided wings. *b*. Plan of the monoplane arranged as a parachute. *c*. Elevation of the monoplane arranged as a parachute

A monoplane that can be converted into a parachute

There can be no insuperable mechanical difficulty in carrying out the scheme here outlined. It would be desirable to be able to place the horizontal stabilizing planes, in falling, symmetrically about the vertical line through the center of gravity, or to turn them into a vertical position, so that the parachute action shall depend essentially on the principal sustaining surfaces.

In the case of dirigible balloons, also, great advantage would be obtained by the application of these two fundamental principles: making the vessel easily convertible into a form which would act as a parachute, and dropping all heavy machinery, on soft ground, if possible, shortly before the vessel strikes, while the passengers diminish the shock of landing by climbing into rings suspended above the car from the bag or parachute. The confidence that the most serious accident would result only in a gentle descent to earth would prevent panic among the passengers and leave the pilot in full possession of his faculties.

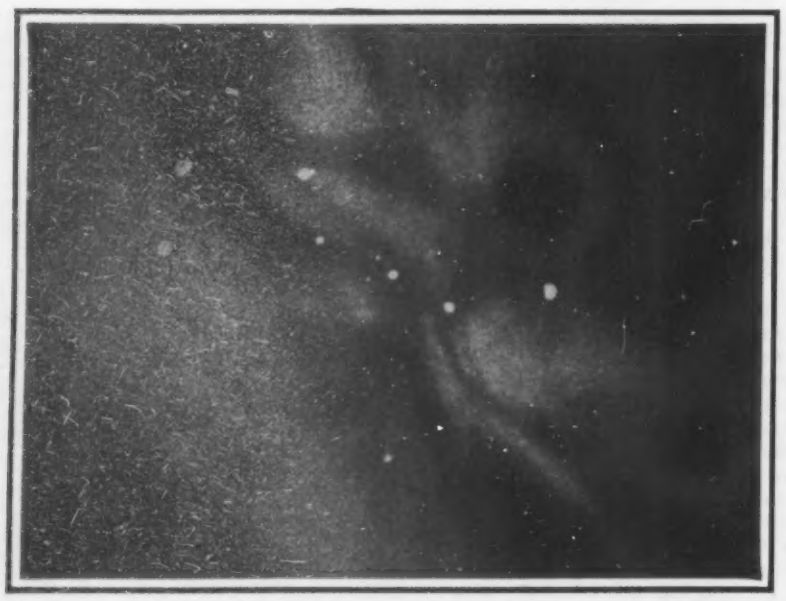
Studies of the Aurora

THE most plausible theory of the aurora is that of Paulsen, which attributes the phenomena to the passage of cathode rays through the highly attenuated upper strata of the atmosphere. Estimates of the height of the aurora vary widely. Auroral streamers have been seen beneath clouds and mountain summits less than 4,000 feet high, and also in high northern latitudes above the lofty cirrus clouds. Dr. Alfred Wegener estimates the height to range from 70 to 400 kilometers (43 to 250 miles). He attributes the so-called "draperies," which seldom extend to a greater height than 43 miles, and the other striated forms to the absorption of cathode rays by an atmosphere of nitrogen, and attributes the homogeneous bows and other forms destitute of rays, which are usually seen at a height of about 125 miles, to absorption by an atmosphere of hydrogen. Acording to Paulsen's observations, auroras occur at all heights, from 300 miles down to the earth's surface. The height of an aurora can be determined by photography, although the motion of the bands and streamers and their feeble luminosity present great difficulties. Prof. Stoermer, in Umschau, narrates how he has succeeded in photographing auroral phenomena with exposures of less than one second. His photographs were made in February and March, 1910, at the Norwegian arctic station Bossekop, in Finnmark, where the German, Prof. Grendel, made the first photographs of an aurora, in 1892. After experimenting with a great variety of plates and lenses Prof. Stoermer decided to use Lumière violet label plates and a kinematographic objective of 1 inch diam-

(*Concluded on page 21.*)

From Umschau

Prof. Stoermer photographing an aurora



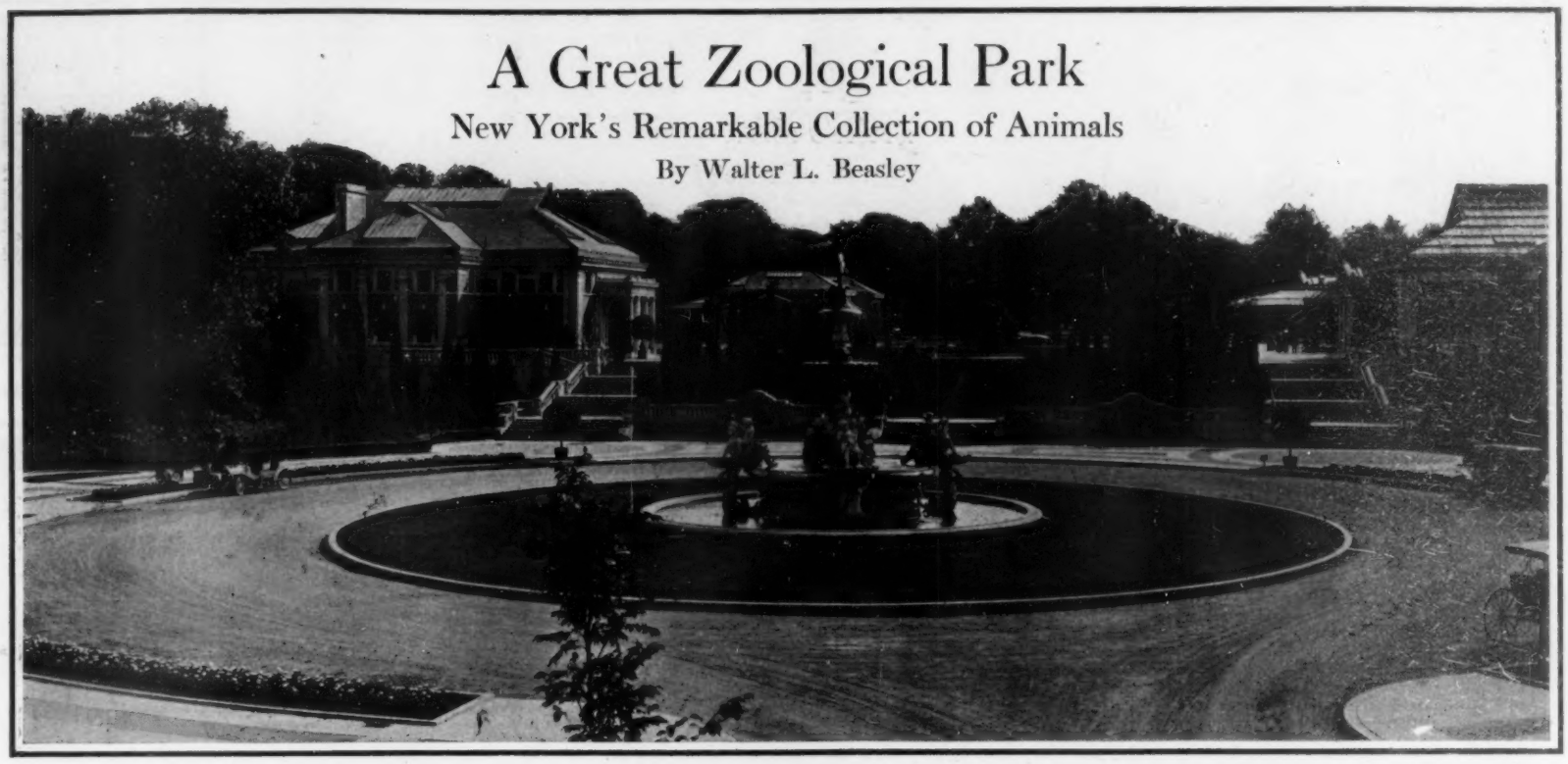
An aurora and the Great Dipper photographed by Prof. Stoermer March 13th, 1910

An aurora and Orion photographed by Prof. Stoermer February 8th, 1910

A Great Zoological Park

New York's Remarkable Collection of Animals

By Walter L. Beasley



The concourse and north end of Baird Court. The new administration building on the left, Rockefeller fountain in center, bird house on the right, primate house in the distance

THE New York Zoological Park, with its two hundred and sixty-four acres marvelously fashioned by Nature for an ideal animal museum, presents for the instruction and amusement of New York the greatest living assemblage of mammals, birds, and reptiles to be seen in any one single spot in the world. This remarkable exposition contains over 5,000 living wild creatures, kept together in comfortable captivity, skillfully fed and tended, and nearly all strikingly exhibited in open-air inclosures.

Through Director W. T. Hornaday the Zoological Society of New York has secured from the jungles, deserts, forests, and mountains of the world, their rarest and most remarkable living animal treasures, in order that the millions may know them by personal acquaintance, and appreciate the marvels of the animal kingdom.

That the people of New York appreciate the effort made by the society is shown by the attendance of visitors at the park during the last year, which by actual turnstile record rose to 1,614,953. To make a park and collection worthy of the fauna of all the continents of the globe, and also worthy of the metropolis of the new world, has been a gigantic task; but thanks to the wise and energetic work of Director Hornaday, and the guidance and co-operation of the officers and members of the Zoological Society, the park, after three years of planning and eleven years of very strenuous work, is now practically complete. Of course, this does not mean that nothing more ever will be added, or that in the future no more improvements will be necessary.

In November, 1889, the park (which never has been closed) was first "opened" to the general public. The original impulse and effort for the creation of the New York Zoological Society came from Mr. Madison Grant, now the secretary and chairman of the executive committee, then a sportsman, student of nature, and by profession a lawyer. Fortunately, very early in its career, the new organization secured the active support of Prof. Henry Fairfield Osborn, now the president of the society. It is impossible to overstate the influence of these two men on the society's undertaking and success. Their efforts to establish the park, add to its beauty, and to advance its interest and reputation, afford fine examples of civic devotion and loyalty. Without them, New York would not have at this time a zoological park.

In its large and ideal grounds, its buildings and outdoor compositions for animals, and in the scientific value of its collections, the New York Zoological Park is to-day one of the foremost institutions of its kind in the world. It is no exaggeration to say that it is in a class by itself. The recent elaborate official report of Dr. Gustave Loisel to the French government has enabled the public to know the relative standing and merits of the zoological gardens and parks of the world. The New York Zoological Park, with its 5,530 living specimens, has first rank; Berlin, with 3,149, second; and London, with 2,972, third. The Zoological Society has expended on the park and its animals about $475,000, and on the buildings and other "ground improvements" the city has expended a little more than $2,000,000. All the animals of the Zoological Park are the property of the Zoological Society, having been presented by its members or purchased out of the profits of the privilege business created by the society, under the authority of its contract with the city.

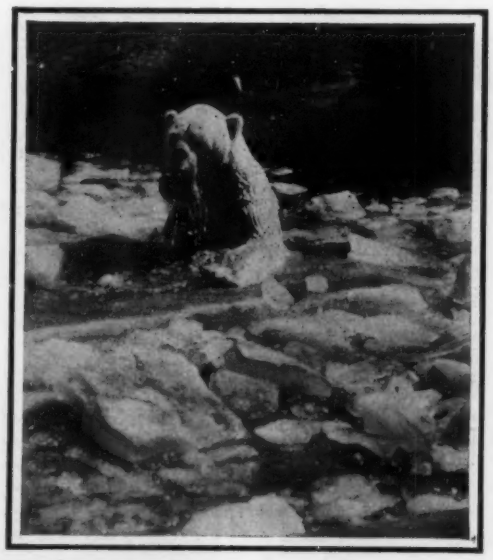
A WONDERFUL ARRAY OF ANIMALS.

Of the great array of noteworthy mammals, birds, and reptiles at present on exhibition in the park, many pages, or even a whole volume, would be needed to convey a fair impression of them. The collections have been formed strictly on scientific lines. Through the courtesy of Prof. Henry Fairfield Osborn, president of the society, the writer was afforded opportunities of securing some close-range photographs for the pages of the SCIENTIFIC AMERICAN, showing a number of the most rare and interesting animals and large birds.

The collections of birds are fairly bewildering in their variety of species and general zoological richness. Over three thousand individuals, representing hundreds of species, gathered from a hundred different localities, are exhibited. The collection contains such feathered rarities as the California condor, harpy eagle, Bateleur eagle, trumpeter swan, whooping crane, sun bittern, seriema, South American trumpeter, gyrfalcon, sea eagle, yellow-necked cassowary, hyscinthine macaw, black cockatoo, black-backed pelican, ptarmigan, and a hundred smaller varieties, making its scientific value beyond question.

Among the latest arrivals are three greater birds of Paradise, from Aru Island, New Guinea, being the first live specimens ever placed on exhibition by an American institution.

The mammoth Flying Cage is one of the wonders of the park. It represents an attempt to do for certain large water birds what has been done for the hoofed animals and other species; that is, to give them a section of Nature's own domain. In this huge cage they can fly to and fro, build nests, and rear their young in real freedom. The cage is the summer home of a mixed flock of large and showy water birds, such as herons, egrets, flamingoes, pelicans, and others. It is fifty-five feet in height, seventy-five feet wide, and one hundred and fifty-two feet long. It completely incloses three forest trees of very considerable size, and contains a deep pool of water a hundred feet long.



Polar bear enjoying lunch amid realistic arctic surroundings among the ice cakes in his pool

A GREAT ZOOLOGICAL PARK

Among the large and rare birds of the Ostrich House is the picturesque emu from Australia, now almost extinct, and next to the ostrich the largest of existing birds. There are three species of ostriches and four of cassowaries.

Of reptiles, 1969 in all, in charge of Curator Raymond L. Ditmars, the collection is very comprehensive. It contains king cobra, spectacled cobra, bushmaster, fer de lance, puff adder, five species of rattlesnakes, five species of crocodilians, and pythons, boas, anacondas, small serpents, iguanas, turtles, tortoises, terrapins, and amphibians in great variety.

HUMANE TREATMENT OF CAPTIVE CREATURES.

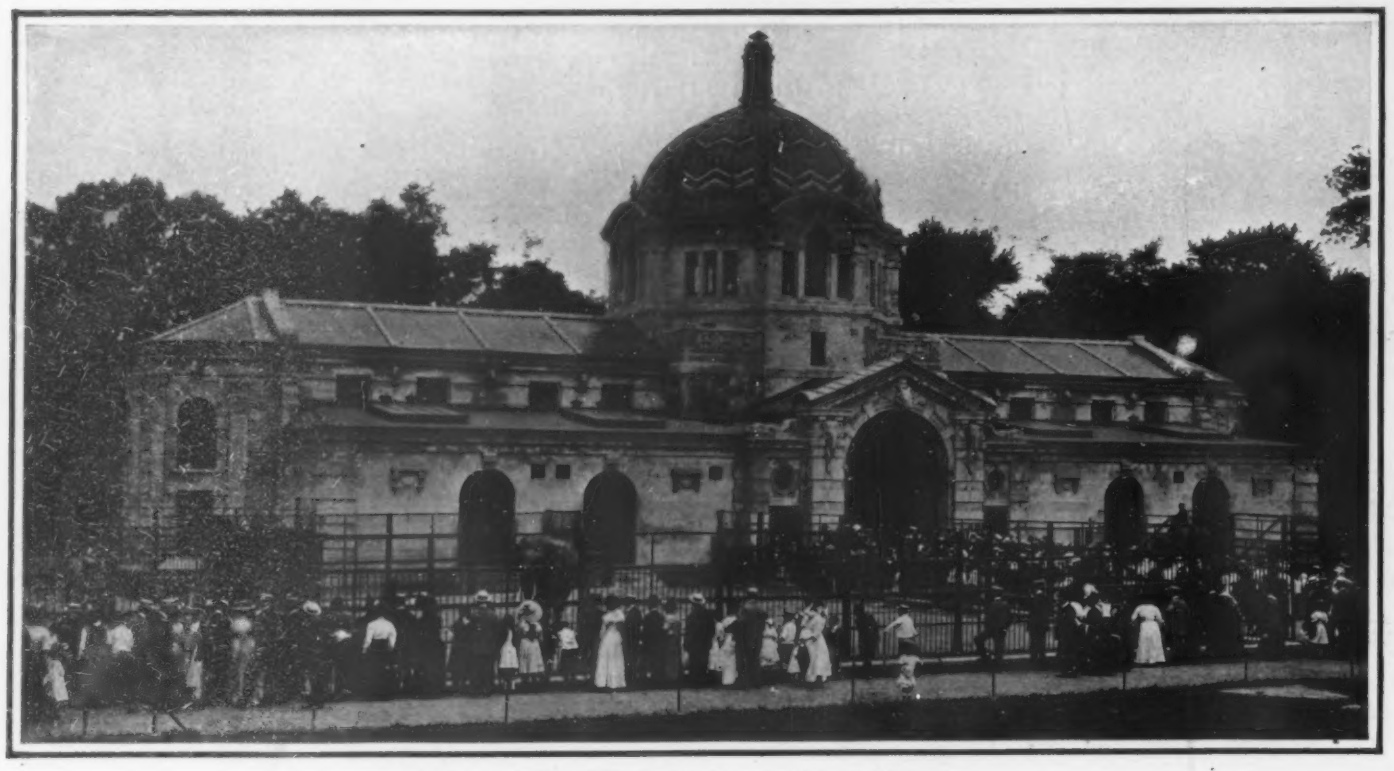
From the beginning, it was the aim of the Zoological Society that the park should be designed and created on lines of the most far-reaching humanity toward its captive wild creatures. Therefore, the utmost of experience and the best skill that man could furnish, and ideal grounds and a fair supply of money, have been skillfully combined to render the wild animal population not only comfortable, but happy from day to day. The spacious outdoor yards for the exhibition and comfort of the wild creatures are one of the unrivaled features of the park. The director says: "For humane men and women there is small pleasure in the contemplation of living creatures that are in prisons, and that look and feel like prisoners, pining behind their bars. Better no zoological parks and no wild animal collections than miserable and unhappy prisoners! A badly made or badly kept zoological park or garden is worse than none. But, at the same time, it is folly for anyone to say that all zoological gardens and parks are dens of cruelty, and is held by a few extreme humanitarians. The creatures in the collections of the Zoological Park give unimpeachable testimony to the contrary. If our bears or hoofed animals, our birds, our apes, and monkeys, are not positively happy, and full of enjoyment of life, then none are in this world, either captive or free. As a general proposition, our animals are not 'pining behind their prison bars.' The vast majority of them are happier, and better fed and watered, than they would be by their own efforts in a state of nature, wherein life is one continuous struggle against hunger and sudden death."

Of the eleven large and important animal buildings, the first class, of brick and stone, each one, except the Reptile House, is provided with an elaborate and extensive series of open-air yards, in which every habitant has, in mild weather, a daily opportunity to spend hours in the sunlight and the open air, freely exercising or lying at ease in the shade.

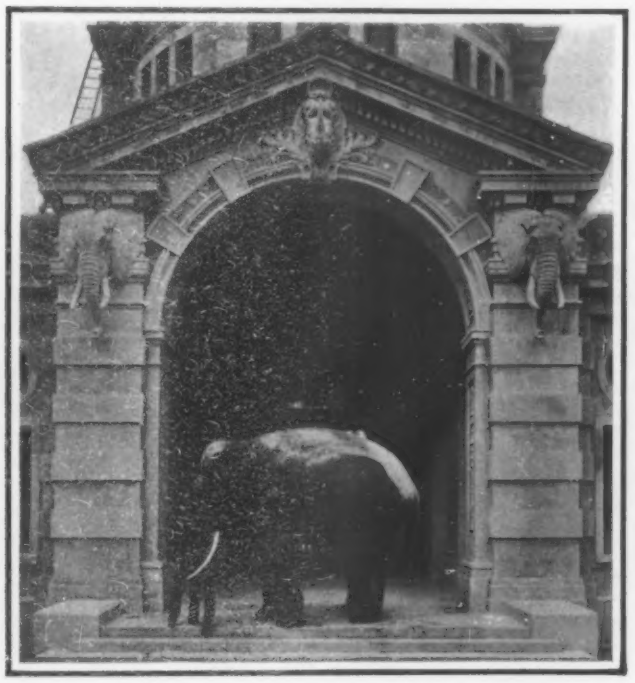
THE OPEN-AIR RANGES.

The fourteen buildings of secondary importance are

(*Continued on page 19.*)



The new Elephant House, showing spacious outside yards



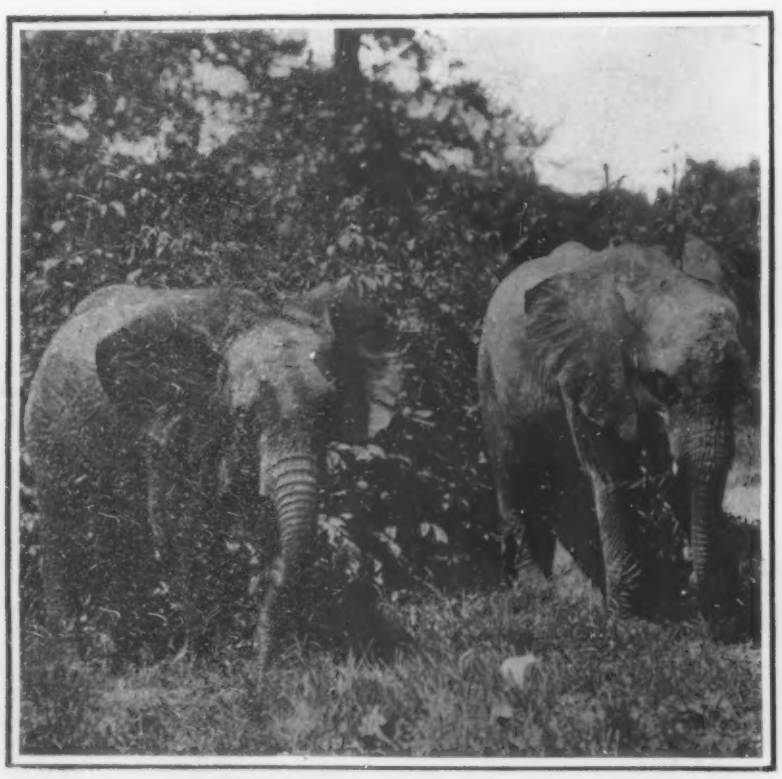
North facade and entrance of the new Elephant House
Sculptured heads by Charles R. Knight

The fine five thousand dollar pair of Nubian giraffes
A striking contrast in feeding

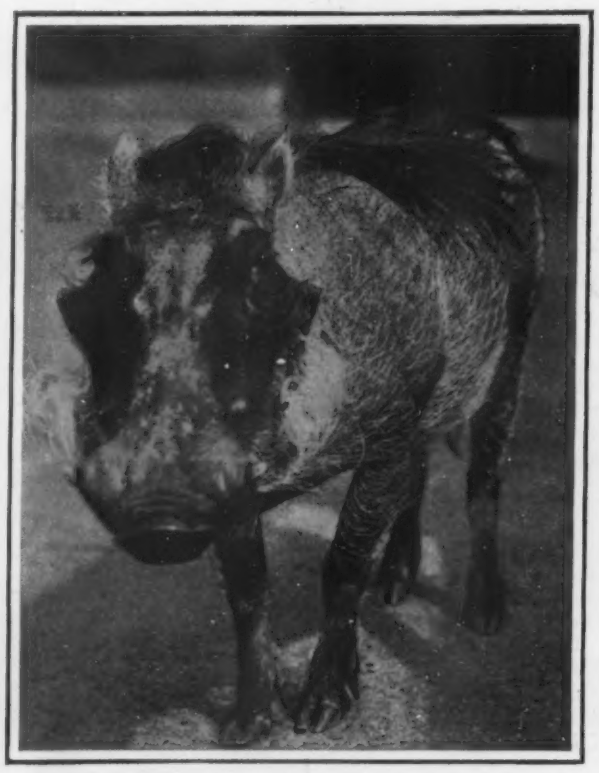
Five baby musk ox ca the o

Rare and beautiful snow-whit atrix a

Dr. Blair relieving the harpy e of a t
interf ith his



Young Soudan African elephants, "Kartoum" and "Sultana"



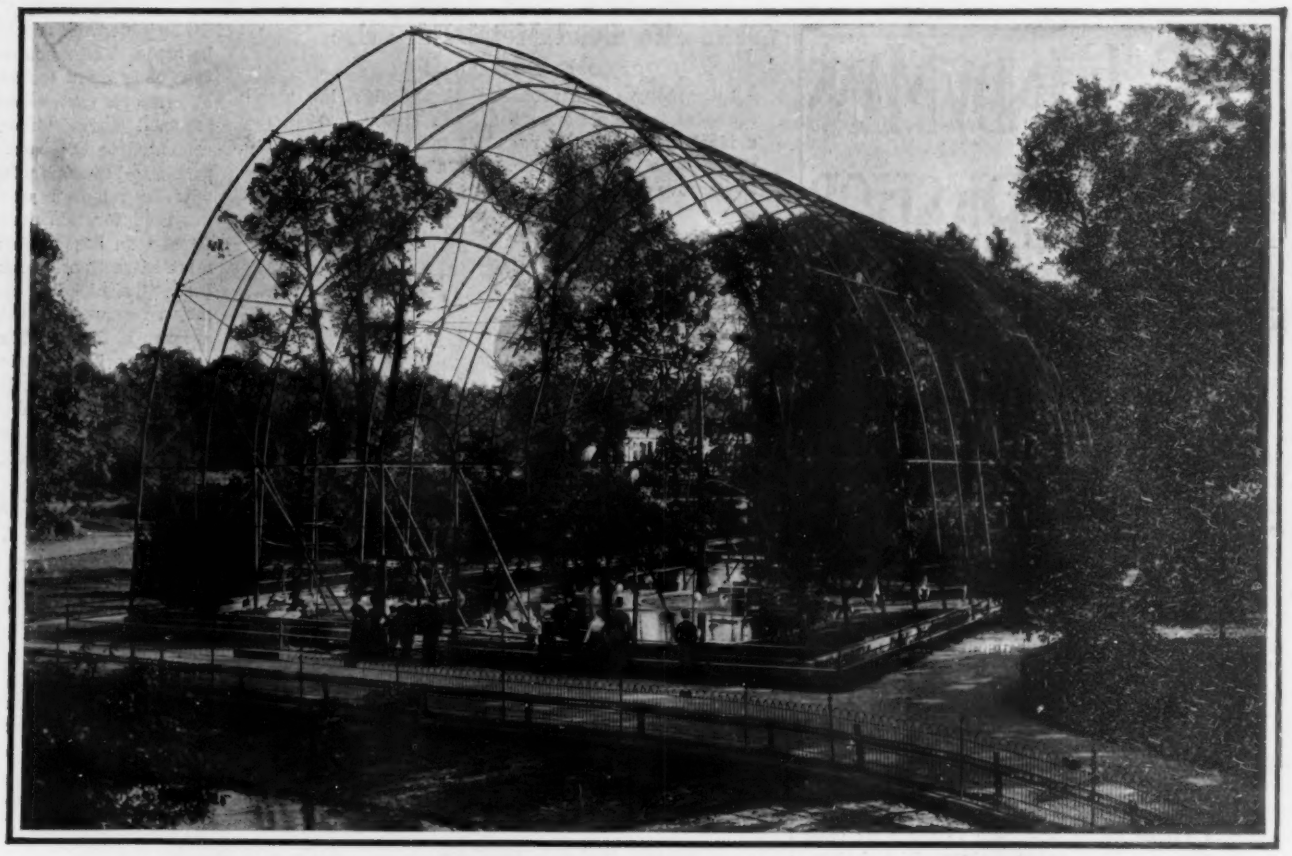
The curious African wart hog

Son of the famous hip iph"

...the only live herd in captivity

...hit...atrix antelopes from the Arabian desert

...rpy...e of a troublesome curved bill, which ...erf...ith his eating



The great outdoor flying cage, for large aquatic birds. The huge structure incloses a miniature forest and lake

The giant harpy eagle from Colombia, the finest in captivity

The stately markhor with gigantic spiral horns

The red river hog, from Africa, considered the handsomest member of the swine family

...hip...iph"

Friendly Australian emu feeding on a banana from keeper's mouth

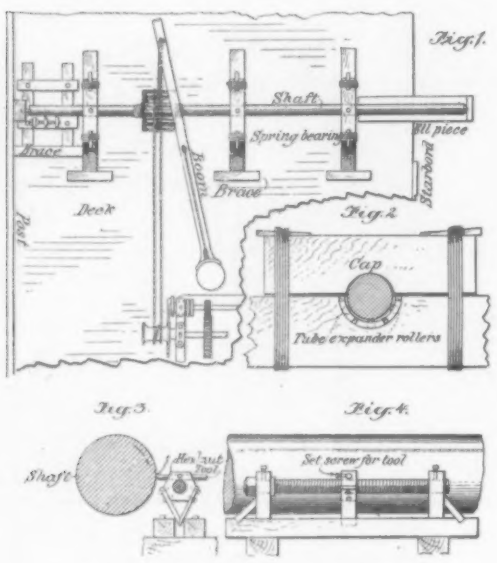
Baby Bactian camel born in park, a few weeks old

Turning a Shaft with an Emergency Lathe

By Thomas Fowler

While stationed on the United States tender "Ivy," when it was anchored on the Florida reefs a hundred miles from port, the writer was called upon to turn a 6-inch shaft 30 feet long. There was no lathe on board, and it was necessary to improvise one. A tool was made out of a half-inch round file, a tool-holder out of a two-inch hexagonal nut, and a screw feed out of a 2-inch bolt 12 inches long. By this means the shaft was turned a quarter inch off for a length of 4 feet.

A diagram of the apparatus used is published herewith. Several pieces of iron plate ½ by 3 inches were bent to the radius of the shaft, and within each three-tube expander rollers were caged, forming roller bearings for the shaft. These were placed in 10 by 10-inch timbers, and braced to the deck. They served as the bottom bearings, and the caps were made of 10 by 10-inch timbers, cut to the radius of the shaft, lined with yellow metal, and held in place by means of rope tightened with wooden wedges. The shaft was so long that it extended several feet over the starboard side. An L-piece was made fast to the deck, and used as a butting block. A piece of 1-inch round steel was pointed and secured in a timber brace, to



Improved lathe for turning a shaft

serve as a lathe center on the port side of the shaft. On the shaft a pulley 20 inches in diameter was rigged up. It was made of two disks of 2-inch plank mounted on the shaft and connected with 1-inch strips 2 inches wide. To fasten this pulley to the shaft so that it would cause the shaft to turn with it, a rope was passed several times around the shaft at each side and then secured to the pulley. The rope was wrapped in such direction as to bind when the pulley was revolved.

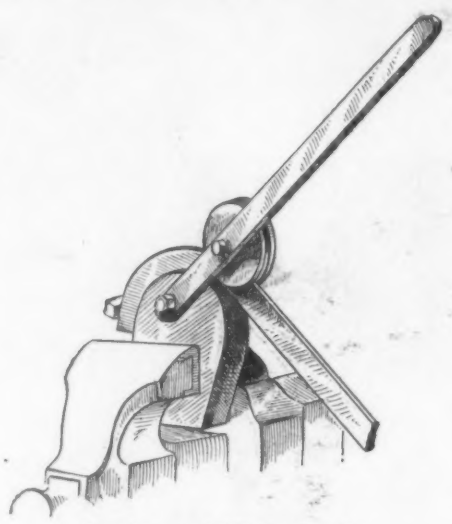
There was no belting at hand, and so a rope belt had to be used. This was wound around the pulley twice, and from there was passed about the nigger-head of the winch, where two turns were made; thence it passed up through a pulley on the end of the boom, and back again to the pulley on the shaft. By raising the boom, it was possible to tighten the rope as it stretched. The shaft was turned by running the winch.

The details of the tool holder and carriage are shown in the illustration. The 2-inch bolt was suitably supported in a pair of brackets, and the hexagonal nut was mounted between them. Two metal strips were fastened with screws to two sides of the nut, so that they came together in the form of a V, with the apex arranged to slide between two rails, as shown to the best advantage in the cross-sectional view. The tool was fitted into a hole drilled parallel with the upper side of the hexagonal nut. It was held in place by means of a setscrew. The tool was fed along the shaft by turning the bolt at each revolution of the shaft, so as to advance the nut. The entire task was completed in two days' time, and the work proved very satisfactory.

To Bend Metal Edgewise

By B. F. Albert

Like many other problems, that of bending metal edgewise is simple enough "if you know how." Take a block of metal, and round it to the form you wish the metal strip to assume. Get a grooved roller with the groove deep enough to receive the metal strip to



Bending a metal strip edgewise

about three-quarters of its width. Bolt or rivet this roller to a lever fulcrumed to the form block at the center from which the curved portion is struck. Hold one end of the strip to the form with a lug, as shown, and then, with the device held firmly in the bench vise, the lever may be operated to bend the strip about the form.

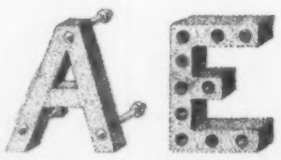
Signs of Cement

By George Rice

While cement block letters have been made and used successfully since the introduction of cement articles in the commercial world, it has been only recently that there has been a practical application of the same. There is always something substantial and convincing in the rock or cement sign which has been made as a part of the structure. Stability is added to the effect by the fact that the sign is a part of the original edifice. While the cement signs can be molded as a part of the building, it is an easy matter to make the base separate and fasten it securely in place with clamping bolts.

Of course, there are well-made signs and poorly-made ones. You need not look far among the signs of this class to find evidences of poor workmanship. You will discover that the weather has had its effect prematurely on some of the signs, and that the corners are worn off and there are cracks. Sometimes the slab is broken, due to excessive pressure of the securing bolts when the slab is based on an uneven level. Sometimes the slab is fractured, due to weakness of the stock. Then there are corners broken or worn off on some of the sign slabs. You can find slabs bearing block raised letters with the edges of the letters badly worn as a result of the rains striking on them. This is due to defective work in the construction of the sign.

If the cement is poorly proportioned, with an excess of "mud," you are going to get a shabby sign.



Cement sign made of block letters

If the molding is done with the stock so soft that the mass is going to cling more or less to the sides of the mold, then you are going to get imperfect letters at the start, the edges will fail to define sharply. The stuff will lag and be sloppy. You may patch and work with the trowel, but without avail. Sometimes the mix is too dry, and a lettered slab is made that may crack and become worthless in a short time.

Much depends upon the character of the letter to be made. The accompanying drawing shows a popular type of letter of the adjustable or portable class. These letters are cast separately. They can be arranged to spell any desired word. The letters are often cemented to the base. But the users of these letters prefer to have fastening devices with which the letters may be removed at will. Sometimes common bolts are used for this purpose, and the letters can be fastened to a base with nuts. The securing devices are more attractive if bronze capped bolts, polished heads, brass tips, nickeled covers, etc., are used. The letters may be ground down with an emery wheel to produce a smooth finish. The block cement letters can be provided with electric lamp sockets, as indicated in the drawing, if an illuminated sign is desired. The light shining on the cement background produces a very striking effect.

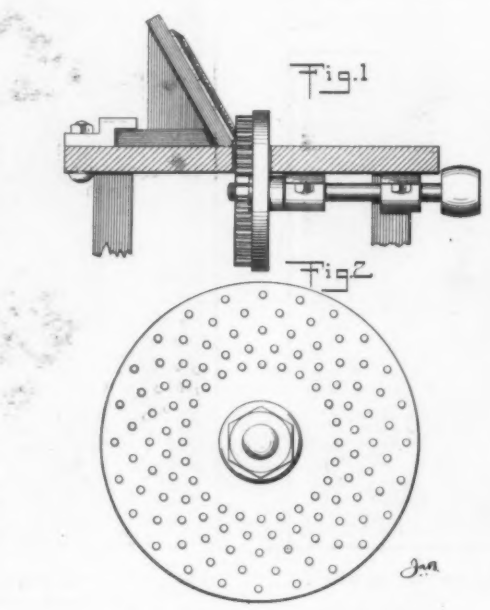
Cutter for Strawboard

By J. W. Bergstrom

The accompanying illustrations show how a very efficient cutter can be made for strawboard and other pulpy substances. Fig. 1 shows the cutter head mounted on the arbor of a circular saw ready for operation, and Fig. 2 shows a face view of the cutter.

The cutter consists of a head or flange made from cast iron, mounted on an arbor, supported in suitable bearings, like a circular saw. In the face of the flange are drilled a number of holes, say about ¼-inch diameter, into which are driven pieces of tool steel, projecting about ½ inch.

On the feed table a suitable guide is fastened in front of the cutter head, into which moves a guide board, placed at an angle thereto, capable of being moved transversely to the shaft or arbor. The guide board can be made adjustable, so that a different angle



Cutter for beveling strawboard

may be obtained. As the cutter head is running at full speed the strawboard to be beveled is either held or clamped to the guide board, and moved in a transverse direction thereto. The teeth of the cutter head will then cut a very smooth bevel on the soft strawboard. The ends of the teeth need not necessarily be of even length at the start, but will soon wear even.

Hints for the Handy Man

Here is a handy little kink for quick repairing of an umbrella, or for one who would like to change one umbrella handle for another and fasten it on solid. Clean out the hole in the handle, and fill it with powdered sulphur. Place the handle in a fixed upright position, and after heating the umbrella rod red hot, push the rod down into the hole containing the sulphur. The hot rod fuses the sulphur, and this when cold will hold the rod securely. This method may be applied to fastening rods into stone, iron, or wood.

When a die is to be hardened, the threads will get too hot because they are not as thick as the rest of the die. Hence they are liable to burn before the body of the die will get hot enough to harden. A bushing should be threaded to fit the die, and the hole in the bushing should be bored to such a size that the walls will be about 0.02 of an inch thick to the bore. The bush is then screwed in the die ready for hardening. When the die is then heated, it will be a uniform heat, and the threads will not burn before the die becomes hot. The die is then hardened, and it will be found that the threads will not get too hard from dipping in oil, as the bush prevents a sudden chill from the oil. A die treated in this way will be found

to last longer and cut better than the die treated in the usual way.

A 2¾-inch hole was bored through a disk of glass 12 inches in diameter as follows: It was intended to use a piece of brass or copper tubing 2¾ inches in diameter on the outside, but there being no tubing of that size at hand, a wooden plug 1 13/16 inches diameter and 4 inch[illegible]as turned up, and a piece of 1/16-inch sheet copper was bent around the plug and fastened so that the copper projected over the end about 3/16 inch. The shank of a broken bit was flattened out and driven into the plug. Through a board 16 inches long and ¾ inch thick a hole was bored just large enough to permit the plug to turn in it; the glass was then fastened to the board concentric with the hole. With No. 60 emery and turpentine the hole was cut, using the board as a guide for the plug, and a brace to turn it. This worked fairly well, but with dry emery better progress was made. Care was taken not to bear down hard, nor to turn fast, for fear of generating too much heat. The plate was cut through in twenty minutes.

How to Clean a Hole While Boring

When boring a hole, the cuttings frequently clog around the bar and cause it to cut large, especially when the bar is nearly as large as the whole. The cuttings fall to the bottom of hole, and jam against the bar. The difficulty can be overcome by winding a piece of copper around the bar spirally as shown. Of course, the wire is to be wound in a right or left-hand spiral, according to the direction in which the bar is to run.

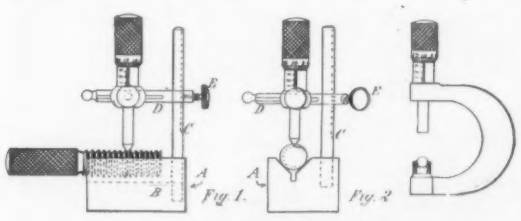
After the coil is wrapped around the boring bar, a little solder is dropped on the wire at intervals of one inch along the spiral, so as to prevent the wire from coming off. In use the wire will convey the chips from the bottom of the hole to the top. A bar fixed in this way will be found very handy for boring blind holes.

Handy Micrometer Tools

By H. D. Chapman

I have found the tool shown here in Fig. 1 of great service when measuring the depth and angles of threads. As I have not seen anything like that in any of the mechanical magazines, it has occurred to me it may be of some service to our friends interested in the gage line.

A V-block *A* is made of machine steel and ground to 45 degrees. A hole *B* is drilled in one side of the V-block, and into it is driven the rod *C*. A cross rod *D*, which carries the micrometer barrel, has a hole drilled in one end, affording a sliding fit on the rod *C*. A keyway is cut in rod *C*, so that stop screw *E* will keep the micrometer in the center of the V-block. When this tool is to be used, we will say to measure a ¾-inch thread gage, the micrometer is adjusted to the zero line, and a ¾-inch plug is laid in the V-block, and the cross rod *D* is dropped down until the point of the micrometer touches the gage. Then the thread gage is put in the V-block and the micrometer is screwed



Handy micrometer tools

down until it touches the bottom of the thread, as shown in Fig. 1. The micrometer is adjusted to suit the depth of thread, depending upon whatever kind of screw gage is to be made.

Fig. 2 shows a simple tool for measuring radial work. In using the ordinary micrometer for measuring radial work, it is hard to get the right measurement, as the anvil of the micrometer lies square across its face, and this prevents the anvil of the micrometer from seating itself in the arc of a radius, making it impossible to get the exact size of a job. The drawing shows the way in which a ball bearing can be used. Take a small piece of brass, about 5/16 inch in diameter and drill a ¼-inch hole through it. The ¼-inch hole is just the size of the anvil of the micrometer. This bushing is slipped over the anvil, which is to be a neat sliding fit. The ball is dropped into the other end, and the top of the bushing is slightly closed, which keeps the ball from dropping out. This will make a handy tool for such work; as I have been using one now for about two years and would not want to do without it.

How to Compute the Velocity of a Bullet

By Frederick B. Gilbert

The velocity of a rifle bullet is found by means of a large wooden pendulum, against which the bullet is fired, and the displacement of the pendulum measured. The pendulum, as illustrated, consists of a block of wood about 8 x 12 x 12 inches, from the middle of one side of which a long board, say 4 inches x 3 feet, projects horizontally. If the rifle to be used is a heavy one, it may be advisable to insert a block of iron in the wood,

Diagram showing the vertical lift

to prevent the bullet from passing all the way through. About in the middle of the board is attached a lug, which presses against a slider on a scale. The block and the bar are suspended as shown in the figure by two fine wires, which loop through hooks and are fastened to the ceiling or a support, allowing about one foot between the two lengths of each wire, to prevent a lateral movement of the pendulum.

Before setting up the apparatus, the pendulum and the bullet must first be carefully weighed. Then the pendulum being suspended so that it is horizontal, the vertical length of the wires must be measured. The slider and the scale are placed underneath, so that the slider is just in contact with the lug, and the reading on the scale noted.

In placing the gun in position, care should be taken to see that it is at a sufficient distance away from the pendulum to keep the sudden rush of gases which follow the bullet from acting on the face of the block. The bullet must strike directly in the middle of the block, and the axes of the gun and of the pendulum must be parallel. Fire the gun several times, observing the displacement of the slider each time, and finally averaging the results.

Before computing the velocity from the data, let us first consider what has happened. The bullet with a mass, m, moving with a velocity, v, strikes the pendulum, and burying itself in it, causes it to move with it as one body. By the law for momentum, the momentum of the bullet is equal to the product of its mass and velocity, mv, and the momentum of the pendulum is equal to the product of its mass, M, plus the mass of the bullet, m, and the velocity of the pendulum V, i. e. $(m + M)\ V$. Now, according to the principle of the Conservation of Momentum,

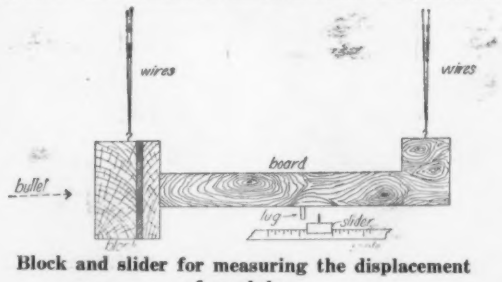
$$(M + m)V = mv,$$

that is, the two momentums are equal.

Transposing, $$v = \frac{V(M + m)}{m} \qquad (1)$$

From this equation we are able to calculate v if we can find V, M, and m. We know M and m already, it but remains to find V.

This may be determined by a consideration of the diagram. The distance s, through which the pendulum



Block and slider for measuring the displacement of pendulum

rises, is the same as if the velocity V were vertically upward. Hence we may use the familiar formula

$$V = \sqrt{2gs} \qquad (2)$$

g being the acceleration of gravity, or 32.2 feet per second, or 980 centimeters per second. The value of s, as may readily be seen from the figure, is determined by the formula

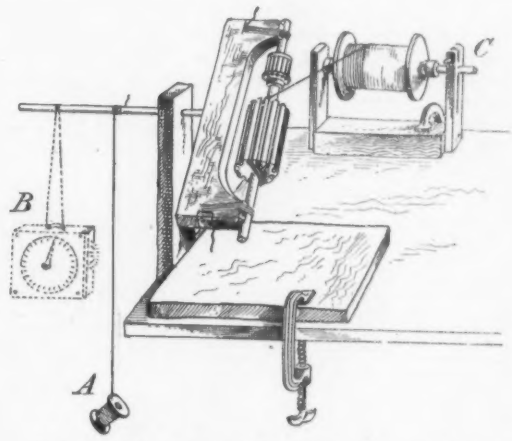
$$s = l - \sqrt{l^2 - d^2} \qquad (3)$$

l being the vertical length of the wires measured, and d the displacement of the slider. Solving formula (2) for V, and substituting the proper values in (1), the velocity is determined in feet or centimeters per second. Care should be taken to employ the same units of measure throughout.

Suggestions for Rewinding Armatures

By A. F. Bishop

A swivel holder for rewinding magneto armatures may be made as follows: Saw out a yoke-shaped piece of wood ⅞ inch thick, and long enough to carry the armature, as in the illustration. Cut a half-round groove in each end for the armature shaft to rest in. Make two saw cuts in each end of the yoke to receive the string with which the armature is bound to the yoke. A small ¼-inch rod is driven into the center of the yoke. This journal fits tightly in the hole of an upright piece that is fastened to the base. It is necessary to have an indicator to register the number of turns of wire when winding an armature. A piece of thread attached to the yoke journal, and allowed to wind as the armature revolves, is a simple method of



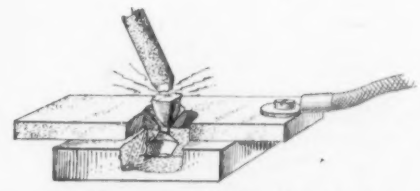
Swivel holder for rewinding magneto armatures

keeping count. But if one is to wind several armatures, it is better to rig something a little better, which is made by taking the works of an old clock, attaching a paper dial and pointer, and revolving this by means of a very small cord or belt, which should run over a small pulley on the escapement wheel shaft, as shown by dotted lines in the drawing. The reel for holding the wire, which should have a resistance on its centers to give a good tension on the wire, is easily arranged as indicated in the illustration.

Casts Made with the Electric Arc

By G. Worts

Owing to the great amount of heat that is developed in any form of the electric arc, it has been commercially adapted for a number of devices where excessive heat is necessary. In cutting metals in manufacturing silicon and such products, it is found invaluable. A method is suggested below for making small casts in which the electric arc is used as the heat source. Casts in brass, zinc, aluminium, silver, gold, etc., can be



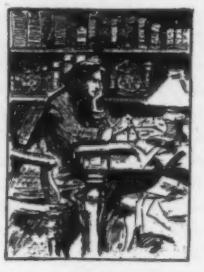
Making a cast with the electric arc

made. Preparations for the casting should be made in the ordinary manner. Form the mold of sand or plaster as advisable, and then over the pour hole place a tablet or slab of carbon about ¼ inch thick. This should have a round tapering hole, the small end of which opens above the pour hole of the mold. A terminal should be bolted to one side of the carbon slab and lead to the current source through a series of heavy resistances. The carbon slab comprises one electrode of the arc, the other being a ¾-inch hard round carbon fitted with a fiber or wood handle.

A small block of the metal to be melted is placed in the depression of the carbon surface, and touched by the other electrode to form an arc. The metal will flow into the mold quickly, dependent on the amount of current supplied to the arc. Casts obtained by this method are very smooth and regular. It is necessary to wear a hood fitted with dense blue lenses, or the fumes and dazzling light will prove detrimental to the operator's lungs and eyesight.

The Inventor's Department

Simple Patent Law; Patent Office News: Inventions New and Interesting



The Professional Inventor

By Joseph B. Baker

THE old-time inventor did his work as an individual, carving fame and fortune in new fields. But the vast growth of manufacturing has changed the status of the inventive art, whereby individual cleverness has been largely replaced, and is always supplemented by definite engineering work performed by a corps of men.

Many of the large manufacturing companies now employ men for their actual or probable inventive ability. Not only the personnel of the research laboratories of these concerns, men who are specifically employed and paid to invent, but department heads and engineers throughout the plant are expected to give thought to the getting up of new machines, devices, arts, or processes, or to the improvement of existing ones, and are required to assign their inventions to the company. Nowadays a detail improvement in some feature of the work, made perhaps by a foreman or operative—some simple change which saves time or labor or material—may be more important in direct money value than a primary invention of former times.

The actual working of the inventions department idea may be illustrated by a few facts from the experience of one of the large electrical manufacturing companies. In 1906, out of the 20,000 men employed at the principal works of this concern, about eight hundred, from all over the factory, constituted the inventing staff.

The contract of each of these men called for the assignment of all of his inventions to the company, "in consideration of one dollar and his employment by the company." The salaries paid ranged from $2,000 to $10,000. The sum of $2,500,000 a year was being spent in fostering and patenting the development work of these men; supplying the tools, appliances, and materials, paying all the bills for drafting, experimental work, and model making, and getting out the patents.

In the year stated about six hundred ideas, out of 1,400 that had been disclosed by a number of these men, were considered valuable enough to be patented. A considerable legal staff is employed to take care of the Patent Office work of the company. The manufacturing methods that are followed in getting out the regular products prevail also in the development of new devices, from the preliminary sketches to the drawing up of one or more patent applications and the appropriation for the manufacture of a small trial lot of the device for general sale. The research laboratories cost about $75,000 a year to run, although the bulk of their work is pure science, furnishing a groundwork only for the making of specific improvements.

Another instance is the National Electric Lamp Association, consisting at present of twenty-three lamp-manufacturing companies. The principal activity of the association is in an engineering department, which spends $350,000 annually and employs a staff of 150 men in three divisions—research, technical engineering, and commercial engineering. In the research division the yearly cost of the physical laboratory alone is estimated at $25,000; and this laboratory is unique among commercial inventions departments in that all of its findings are reported to the proper scientific bodies and given to the world at large.

The modern telephone service is an example of the application of engineering inventive methods in the development of a complete system, in contrast to the work of the early, individual inventors of the instrument which is the basis of the art of telephony. In this development work the object was not primarily the reducing of costs, but the meeting of very pressing problems incident to the marvelously rapid growth of the business. The history of the telephone is full of shining examples of individual inventions of high order, but the object stated certainly could not have been served but for the co-ordinate work of a great inventive staff.

James W. Gayley, an ex-vice-president of the U. S. Steel Company

His dry-blast air process is saving hundreds of thousands of dollars every year

A practical working apparatus for transmitting the spoken word over an electric wire was produced by the inventive labors of Bell, Gray, Edison, Berliner, and others, but this achievement was only the beginning. To make the "scientific toy" which Sir William Thomson saw and heard at the Philadelphia Centennial in 1876 the basis of the present vast network of telephone communication has required the concerted efforts of hundreds of inventive workers. It has been in inventions departments—the laboratories of the Bell and independent telephone manufacturing companies, and the maintenance departments and repair shops of the local operating companies—that the multitudinous devices required for making the telephone of practical use have been worked out. The experts of the three or four large corporations which manufacture or operate the bulk of the telephones of the country have met and solved the problems incident to the vast extension of the service by aggressive organized efforts—experimental work based on exhaustive research in pure physics and mathematics.

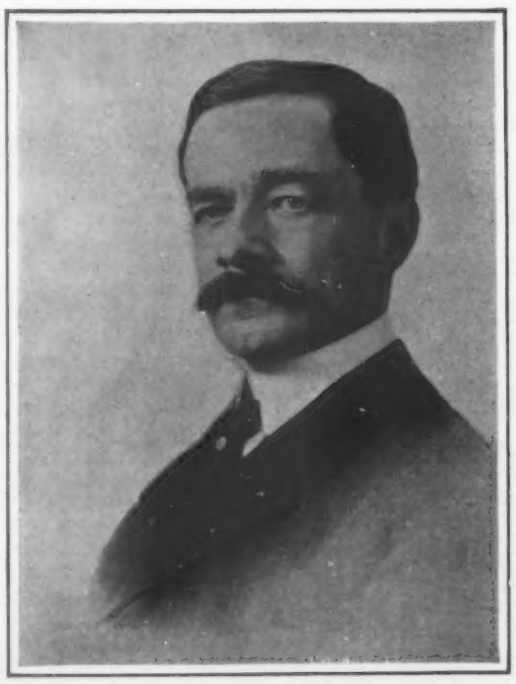
In the Bell organization, following the invention, in the early 90's, of the "solid-back" transmitter, now universally used, which made long-distance working possible, the limits set to talking distance by the properties of existing lines presented a new set of problems. To render the long-distance lines more efficient and enable longer distances to be covered called for two separate campaigns of investigation, in which groups of telephone inventors in the several experimental organizations vied with each other to produce a practical telephone relay or repeater, and to improve and standardize metallic-circuit copper-wire lines. The prosecution of work in these lines continued for many years, improvements as made being put into practical operation to meet urgent need for them and serving as apparatus at the common disposal of telephone men generally, for all to try to improve upon. The organized researches on these two lines resulted in many useful inventions made by the way. Among the early results of the work were the introduction of hard-drawn copper wire of standardized diameter and physical and electrical properties, and standardized pole-line construction designed to withstand high wind pressure in winter when the wires are loaded with ice, and including transpositions to avoid "induction" and "cross talk." Again, following public sentiment which demanded the putting of all wires underground, the cable conferences that resulted in the standardization of paper telephone cables exemplified the teamwork method of attacking difficulties. The low electrostatic capacity and high insulation resistance of dry air, secured by dry paper loosely laid up between the two conductors of each "twisted pair" in the hermetically sealed lead cable sheath, was embodied in various cable constructions evolved by as many different groups of men. These different plans became the basis of "conference cable" specifications, under which cables were manufactured for use by every telephone operating company in the field.

Meanwhile the army of workers on switchboard and operating and traffic problems had not been idle. Out of the necessities arising from the phenomenally rapid growth of the service in the large cities, with its incidental problems of prompt and economical handling of local and long-distance calls, saving of floor space occupied by switchboards, elimination of local battery inspection, etc., grew up the modern "common battery system," with its simplified telephone sets at subscribers' stations, lamp-signal switchboards, and highly organized operating methods—the work of many men, each of whom contributed his effort in the improvement of some feature of the work.

The telephone system of to-day is represented in the Patent Office by thousands of patents, the great majority of which are for detail devices. To a single individual employed by the Western Electric Company—Mr. Scribner—over eight hundred patents have been issued, mainly on switchboard and substation devices; but his work has been that of an extraordinarily prolific inventing engineer, in touch from the first inception of every device with the work of scores of other men—his own assistants and members of other experimental staffs—and not in any sense that of an inventor of the old school.

The inventions department that has built up the telephone service was called into being by the general growth of a communication system. But such departments are not confined to electrical manufacturing interests. Instances of organized inventive work in mechanical engineering required to save the life of a great industry in a given community threatened by changing conditions of the supply of raw material are the Hulett and the Brown systems for the rapid and economical unloading of ore and

(*Continued on page 20.*)



J. J. Carty, a telephone engineer whose inventions have done much to improve the telephone

C. E. Scribner, who has patented about eight hundred inventions

Patent Oddities

Electric Trousers Creaser.—In order to enable a man to crease his trousers conveniently and without removing them, an ingenious inventor has constructed an electric pressing iron adapted to slide on a vertical guide rod. The latter is fitted with a stirrup at the lower end for the operator's foot, and a handle at the upper end by which it may

Electric Trousers Creaser

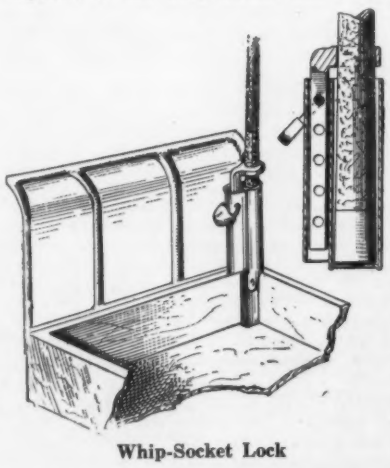
be held steady. The pressing iron consists of two spring-pressed, electrically-heated plates; between which the material to be creased is placed. The iron is furnished with current tapped from a lamp socket by means of an ordinary plug and connecting wires.

Support for Automatic Guns.—To facilitate the firing of heavy automatic guns, a support has been invented, which is illustrated herewith. A pair of legs are fitted to the barrel of the gun, while the stock of the gun rests on a movable support consisting of a shank fitted with a roller that travels in an arcuate groove formed in a base plate or shoe. The shoe is rested on the ground, and the proper elevation of the stock may be

Support for Automatic Guns

secured by means of screw adjustment on the shank of the support. This screw adjustment may be thrown out at a moment's notice, permitting the gun to be elevated or depressed at once to approximately the desired position. The screw, however, permits of careful adjustment thereafter. In use, the stock of the piece is held against the shoulder as shown.

Whip-Socket Lock.—Whips are so frequently and easily stolen, that an inventor has suggested a simple but effective means of making them fast in the socket when they are not in use. A holder encircles the whip, but is not large enough to pass over the butt of the whip. A shank on this holder extends downwardly into a hollow sheath adjacent to the whip socket, and a pad-



Whip-Socket Lock

lock is shackled through this sheath and one of a series of holes in the shank of the holder. This makes it impossible to remove the whip without breaking either the padlock or the socket.

Brief Notes on Inventions

Filtering Cigar Smoke.—For the purpose of filtering the smoke of a cigar, a small cartridge has been devised, consisting of a layer of blotting paper and one of cotton texture rolled up into a small cylinder covered with waterproof paper. This may either be inserted into the cigar, or else be embodied in it during the process of manufacture.

Wheel Hubs.—Automobile wheel hubs are, in many instances, made of a special design, and indicate the make of the car so long as the car is standing still. Cannot some one invent a wheel hub that will be distinctive in its appearance, and will present the same distinctive appearance at all times, whether the car be standing still or moving?

Korean Patents.—Imperial ordinances have been passed relating to the protection of industrial property in Japan and Korea under the treaty of annexation. The ordinances decree that all patents, trade marks, etc., in effect in Japan on August 29th, 1910, became effective throughout the kingdom of Korea on that date. The provisions of all patents, trade marks, etc., granted by the Japanese government since August 29th, 1910, will, generally speaking, extend to and throughout the kingdom of Korea.

Counting Eggs as They Are Laid.—A Buffalo man has patented an egg marking device which is described as "adapted to be attached to a hen to mark the eggs as they are being laid." The purpose is to ascertain the laying capacities or qualities of a hen by marking each egg as it is laid and this is accomplished by a device attached to the hen itself. Securing rings, apparently of metal, are passed through the cartilaginous parts of the hen and co-operate with spring devices in securing the marking devices in position on the hen so that as the egg is laid the marking device is brought into position to produce on the egg the distinctive mark appropriated to the particular hen. The patent was issued in September, 1910.

Blind-Operating Device Needed.—Outside blinds are especially desirable in country houses, and screens outside the sashes are preferred because they permit the movement up or down of the sashes without disturbing the screens. An architect who builds many country houses of the better class, says there is a demand for an improved device for operating the outside shutters from within the house. Such an invention should avoid the defects of some of the shutter workers on the market, which have a tendency to break under the strain and the influence of extreme cold. He says the ideal worker should be proof against the weather, be sightly, or out of sight, both within and outside the house, be easily operated even in a high wind, and not be too expensive, either in its production or application.

Freak Inventions.—A patent was issued years ago for a fire escape including a parachute attached to the head of the wearer and thickly padded shoes applied to his feet. This might be found useful by aviators. Another patent of interest in aerial navigation was granted to a resident of Paris, France, who replaced mechanical motors and propelling and guiding arrangements for balloons by living motors in the form of birds such as eagles, vultures, condors, etc., which he proposed to harness to a balloon "in such manner as to leave their wings in perfect liberty," means being provided so that the operator can direct the flight of the birds to propel and steer the balloon. Another inventor, fearful of fire, incorporated cords or strings with a pair of suspenders in such manner that in case of fire the cord might be detached and lowered to the ground to receive a rope which might be raised to the window and afford a means of escape from the burning building.

Legal Notes

Making Patented Inventions.—It is a widespread idea that one has a right to make a patented invention without the consent of the patentee, for his personal use only, and not for sale to others. This is entirely incorrect. The patent law grants to the patentee and those holding under him the exclusive right to the manufacture, use, and sale of the patented invention. No one has a right to make a patented thing for his own use. As a matter of fact, it has been held an infringement to make a patented article, although it was never used by the maker. The courts have gone so far as to hold that a device constructed originally not to infringe, but with the intent that by the wearing of its parts it should become an infringement, is an infringement.

X-Ray Evidence.—An entirely new use has been found for the X-ray machine, namely, in acquiring evidence. The case was that of Browder versus Commonwealth, 123 Southwestern Reporter, 328. A negro was on trial for shooting and killing a white man. He did not deny the shooting, but claimed he shot in self-defense. The deceased after the shooting had a pistol. Defendant claimed that he had been shot in the breast by deceased, which was the beginning of the difficulty. It would necessarily follow that if defendant was shot, and if he could affirmatively prove it, then a case of self-defense would be clearly established. Accused moved for a continuance in order that he might be examined with the X-ray by a physicion to show that he was shot in the breast and that the bullet had lodged in his back. The court on appeal held that defendant on return of the case might be taken from jail to an X-ray machine and examined; for this fact, if proved, would strengthen his testimony as to what occurred at the time of the homicide.

Bleached Flour Process Illegal.—Shawnee Milling Company versus Temple, 179 Federal Reporter, 517, is a suit in equity to restrain certain United States officials from seizing complainant's flour in interstate shipments under the national pure food law. The allegations are that the flour is whitened and aged by a process, and that the same is not harmful, but is more nutritious, wholesome, and attractive for making bread, and does not come under the ban of the pure food law. The flour was found to have been bleached by the agency of nitrogen peroxide gas under a patented process. The result is that new wheat and of an inferior quality is converted into flour with the appearance of flour from a better wheat that has been aged by time. Two processes are patented to produce this result, the Andrews and the Alsop. Under the Andrews the nitrogen peroxide gas is produced by combining nitric acid with a metallic compound. Under the Alsop it is produced by subjecting atmospheric air to a flaming electric arc. It is claimed by some that nitrogen peroxide is the agent for bleaching under both patents, while others claim that it is the ozone that does the effective work, while the nitrogen peroxide is a by-product when the ozone is thereby created. Whatever the truth is as to what does the bleaching, it is both claimed and denied by chemists who ought to be able to agree that the flour is poisoned by such process. But it is known that, after the air is thus subjected to continuous flaming electrical discharges, the resultant gas is conveyed by means of pipes to a compartment, and there is commingled with the flour agitated or in a cloud, and thus subjected to such treatment it becomes dry and white. The court held that this process is illegal and comes under the ban of the pure food law. The court also passed upon the constitutionality of the act, declared it valid, and held that the officials had acted within the scope of their authority in enforcing it.

RECENTLY PATENTED INVENTIONS

These columns are open to all patentees. The notices are inserted by special arrangement with the inventors. Terms on application to the Advertising Department of the SCIENTIFIC AMERICAN.

PERTAINING TO APPAREL

SHOE.—A. F. S. LYONS, Neehah, Wis. This invention relates particularly to a novel form of back stay. An object is to provide a furcated back stay, the tongues of which will engage the opposite sides of the vamp or foxing and thereby form a positive lock at the junction of the quarters with the vamp or foxing along the back seam.

METHOD FOR FORMING SHANKS FOR BOOTS AND SHOES.—J. E. DAVIDSON, Toronto, Canada. The invention has reference to boots and shoes, and provides a method of producing shanks for the same from laminated wood in a very simple and economical manner, the shank produced not being liable to shrink, swell, check or split, and will retain its shape.

ELECTRICAL DEVICES

CONDUCTOR-SPLICER.—F. W. OETTGEN, New York, N. Y. This invention has in view a device embodying a helically-wound spring member adapted to receive the conductor, and a device having screw-threaded parts associated with the spring member to bind the latter about the wire when the parts of the device are threaded together, the spring member being preferably constructed with convolutions having inclined or cam outer faces upon which the adjacent convolutions of the members are adapted to ride.

TELEGRAPH SENDING-MACHINE.—J. R. JONES, Port Arthur, Ontario, Canada. An object of this invention is to provide a device of the so-called automatic type, of light weight, of compact construction, which may be carried in the pocket, and which may be inserted in place of the lever of an ordinary telegraph key by simply removing the latter from its pivotal supports.

SIGNALING APPARATUS.—G. H. CAUGHREAN, Ketchikan, Alaska. The main purpose in this case is to provide an electrical apparatus which will do away with the bells in common use by so placing a receiver and a transmitter that the one acts on the other to produce a whistling or howling sound which can be used for the signal.

OF INTEREST TO FARMERS

STACKING DEVICE.—C. F. WAY, Elm Creek, Neb. Mr. Way's invention has reference to improvements in devices for stacking hay in the field, its object being to produce a device by the use of which hay can be removed from a stacker and stacked in the field expeditiously and with a small expenditure of labor.

YOKE FOR CATTLE.—C. T. CARLETON, Portales, New Mex. The improvement pertains to yokes for cattle, and its object is to provide one which may be constructed at little expense, and which is strong and durable, the yoke being adjustable and the whole arrangement being such that the yoke is certain in its action.

PLOW.—R. CUNNINGHAM and M. FRIAR, Blanchard, N. D. The invention provides a mold-board of a right or left hand plow with a removable share and means of securing the same in position without the use of bolts; and provides resilient connections between the board and the plow share, which will absorb shocks that the latter may sustain if a stone or other obstacle is struck by the share, and thus prevent injury thereto.

THRESHING-MACHINE.—H. EWOLDT, Grand Island, Neb. Among the principal objects which the present invention has in view are: To provide a threshing machine of novel construction and operation, and efficient means for separating the grain and the straw preliminary to the introduction of the same on the winnowing tables; and to provide a construction which is durable and economical.

CHURN-BODY.—W. W. LILES, Mineral Wells, Texas. The invention relates to improvements in churn bodies, or receptacles in which cream is to be churned into butter, and has for its object to produce a simple and efficient churn body, which will maintain the cream in condition best adapted for churning. The present application is a division of a former application filed by Mr. Liles.

ATTACHMENT FOR HARROWS.—J. H. SHERARD, Sherard, Miss. The invention refers to manually-controlled harrows used to level plowed soil that is divided into beds by longitudinal furrows, and provides means for pendently connecting a leveling device with the frame of a harrow, which will permit the leveling device to conform with the general surface of the soil over which it is drawn, independently of the action of the harrow teeth on the plowed soil.

OF GENERAL INTEREST

WINDOW-SILL.—G. H. GERAERDTS, New York, N. Y. An object in this instance is to provide a sill preferably made of cement, or other cementitious material, and arranged for sup-

(Continued on next page.)

port at the ends only, so that the middle portion is unsupported, and hence the window sill is not liable to crack in case the building settles.

FEMALE URINAL.—W. S. Ross, New York, N. Y. In this improvement use is made of a receptacle having a flat bottom, converging sides, an inclined top having its front edge inclined upwardly and forwardly, a rear end for closing the end of the bowl, and a front end united with the bottom and the lower front portions of the sides, the front end having its front inclined upwardly and forwardly and its top edge inclined rearwardly and upwardly.

TOBACCO-PIPE.—A. Q. WALSH, New York, N. Y. This inventor provides the pipe with a suspending and supporting device or ring, which is hinged to swing into a convenient position for use, and is adapted to fold against and conform to the pipe and form a portion of the pipe trimming when it is to be disposed inoperatively.

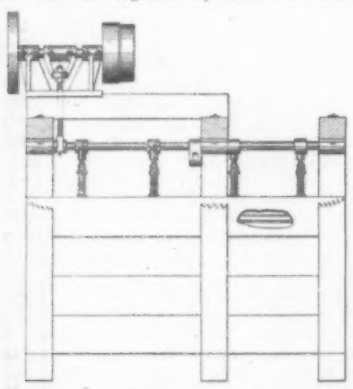
DENTAL APPLIANCE.—L. G. MORGAN, East Orange, N. J. In this case the invention refers to dental appliances, the more particular purpose being to provide means for exerting a gentle tension upon a tooth, in a direction contrary to that of a working pressure exerted temporarily upon the tooth by action of a drill or other implement in the hand of a dentist.

SIPHON.—L. RIEBE, Summithill, Pa. The aim here is to provide a siphon by means of which fluids of different kinds can be drawn from vessels or other containers, in accordance with the well-known principle of the siphon in which the accumulation of air within the siphon tube is prevented, and which is continuous and certain in operation.

ADVERTISING DEVICE.—P. C. SCOTT, Council Bluffs, Iowa. In this instance the invention produces a device for use in street cars, or in public places, which will display an advertisement or a section of reading matter, hold it in view for a predetermined length of time, and will then replace it by another advertisement or section of reading matter.

PAPER-PULP SCREEN.—H. E. SPRING and W. H. LOCKWOOD, Fitchburg, Mass. The invention has reference to paper pulp screens, and it has for its purpose the provision of plates with shoulders having tapering grooves, with which a wedge member is adapted to engage to clamp them together, guides being provided for the wedge members.

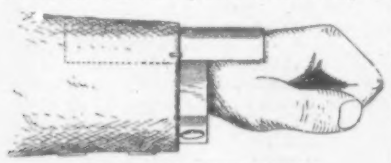
OPERATING MECHANISM FOR ORE JIGS.—WILLIAM A. BRADLEY, Blair, Nevada. An improvement in gearing used in ore jigs is provided by this invention. It consists of a plurality of locking shafts provided with tappets and connected together by links and cranks



OPERATING MECHANISM FOR ORE JIGS.

in such manner that the shafts rock in opposite directions, one group of tappets being raised while another group is lowered, the tappets playing upon plunger rods which are connected with the plungers for agitating the ore and the liquids with which the ore is mixed.

CUFF ATTACHMENT.—F. HUSTACE and J. J. SMIDDY, Box 541, Honolulu, Hawaii. In order to reduce the laundry bills of the man who is accustomed to making notes on his cuffs, a simple memorandum tablet and a better surface has been provided which may be



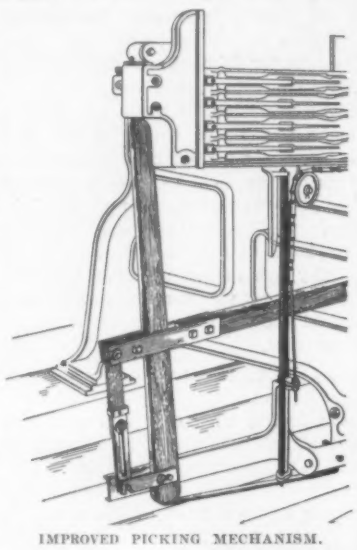
CUFF MEMORANDUM TABLET.

used with the ordinary cuff. It comprises a support arranged between the cuff and the sleeve, normally concealed from view. This may be moved out when desired, and it carries a sheet of material upon which memoranda may be jotted down, and from which the writing may be erased without injury to the sheet.

COMBINED PAPERING BOARD AND SCAFFOLD.—C. H. TABER, Woodlawn, Pa. Mr. Taber's invention has reference to papering boards and scaffolds, and it has for its object the provision of one in which the papering board is supported on the scaffold, making it unnecessary for the workmen to climb down from the scaffold to paste each strip of paper.

MACHINES AND MECHANICAL DEVICES

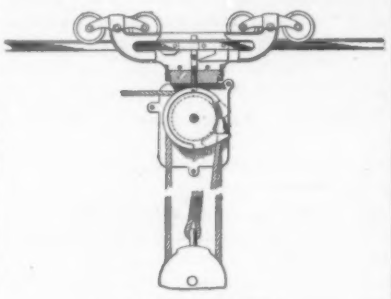
PICKING MECHANISM.—L. E. MELLOR and F. W. COLE, Guilford, Maine. This invention relates to power looms and provides an improved picking mechanism arranged to insure a proper motion of a picker stick without requiring leather straps, or the like. It permits



IMPROVED PICKING MECHANISM.

of adjusting the sweep stick relative to the picker stick, according to the power to be given to the picker stick for sending the shuttle through the open shed with more or less force. The sweep stick has a loop for engagement with the picker stick and a supporting device independent of the picker stick for supporting the loop end of the picker stick.

AUTOMATIC CARRIER.—M. H. CAWLEY, 657 Jefferson Street, N. E., Minneapolis, Minn. The hoist illustrated in the accompanying engraving is adapted particularly for the use of builders, but it may be used to advantage wherever there is need of a hoist and conveyor. It contains means for locking the carrier at hoisting stations and for automatically re-

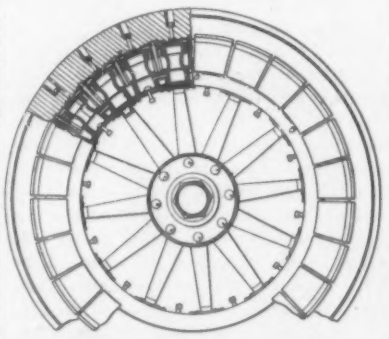


AUTOMATIC CARRIER.

leasing it. Adjustable devices are provided for regulating the height to which the load may be raised, and a system of temporary automatic releasing and holding devices may be located at intermediate stations of the carrier track. Owing to a swivel connection between the carrier and the hoisting devices, the carrier may be operated at different angles from the source of power.

PERTAINING TO VEHICLES

VEHICLE WHEEL.—OSCAR TREIER, 850 East 165th Street, New York. With a view to designing a wheel for automobiles and similar vehicles, which will be proof against puncture, Mr. Treier has invented the construction illustrated herewith, which employs an outer



PUNCTURE-PROOF PNEUMATIC WHEEL.

tire of solid rubber, bolted at intervals to flanged tread plates. These, in turn, rest on pneumatic chambers seated in the rim of the wheel. The chambers are located in telescoping compartments and are connected by means of a tube common to them all so that they may be inflated simultaneously.

NOTE.—Copies of any of these patents will be furnished by the SCIENTIFIC AMERICAN for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

Notes and Queries.

Kindly write queries on separate sheets when writing about other matters, such as patents, subscriptions, books, etc. This will facilitate answering your questions. Be sure and give full name and address on every sheet.

Full hints to correspondents were printed at the head of this column in the issue of June 18th, 1910, or will be sent by mail on request.

(12342) R. O. W. says: I wish to know the result of following experiment: A coil is wound of, say, four hundred turns of double cotton-covered magnet wire, No. 14 B. & S. gage, on a fiber tube. After covering with an insulating medium, another separate winding is wound over this first coil (like the secondary of an induction coil) and containing same number of turns and same gage of wire as first winding. A closed-circuit laminated core is finally supplied, making an apparatus similar to a transformer in construction. 1. What will occur if a sixty-cycle alternating current is supplied to the first winding and a current of 120 pulsations a second is supplied to the secondary, assuming this pulsating current to be in phase with, say, the A. C. positive waves and in antiphase with the negative waves? Would any of the A. C. waves be neutralized or destroyed? 2. What would be the effect of a continuous current supplied instead of a pulsating one on the secondary? A. We have never seen the arrangement you describe for combining the wave forms of two currents, but we should expect that the same result would follow as in all other combinations of wave forms. The pulsating current would be impressed upon the wave of the alternating current to increase the positive waves and to diminish the negative wave form. Plot the alternating-current wave upon the continuous current and you will have the result. This is done in the telharmonium of Dr. Cahill, producing beautiful music from an arc lamp which is lighted by a direct current.

(12343) J. C. says: Is not the unfinished or rough side of leather belting the proper side to have next to pulleys? Which side gives the best results, and what percentage has this one over the other, in new belting especially? A. The hair side of the belt is smoother and stronger than the flesh side, hence it will adhere better to the pulleys and pull more; but as it wears away, the belt is weakened more than would be the case if the flesh side were put against the pulleys to take the wear. We believe the majority favors the hair side outside, but for no other reason than the idea that "it looks better so." As heavy belts are usually double, with both sides hair side out, the question of durability vs. surface friction is rarely raised, and no figures are available giving the percentage of difference.

(12344) W. E. S. says: Please say what is the difference between a series and a shunt wound electric motor, and describe series winding if possible in a simple way. A. A dynamo or motor has two windings, the field and the armature coils. In a series-wound machine these windings are connected together as one continuous wire, so that all the current flows through both field and armature before it comes out of the machine. In a shunt-wound machine the ends of the field and armature are joined together, two and two, and the line wires are attached to the junctions. If the machine is used as a dynamo, the current from the armature divides between the field and the line, a small part going through the field to magnetize it, and the large part going through the line to do work. In a motor the same division of the inflowing current takes place; the part flowing through the field magnetizes the field, and the part through the armature produces the torque, or twisting force which does the work. SUPPLEMENT No. 600, price ten cents, gives diagrams of all forms of winding clearly shown, so as to be clearly understood.

(12345) J. J. asks: Could you please tell me if an aeroplane could rise in the air if it were placed perpendicular to the earth in such a way that the propeller would be pointing skyward and the tail down? If so, how fast would a 25-horse-power monoplane rise? Would a machine which had wings that flapped, fly? A. An aeroplane would not rise under the conditions you state. The weight of the machine would be far too great. When an aeroplane runs along the ground, its planes (which are set at an angle of 10 or 12 degrees with the ground) produce a lifting effect from eight to ten times as great as the thrust of the propeller. Consequently, you can see that if the machine was dependent upon the thrust or pull of its propeller alone, it could not lift. The aeroplane works upon the principle of the inclined plane. It is much easier to lift a weight by moving it up an incline than by lifting it vertically, and much less power is required. The planes of the aeroplane travel up an incline of air. No successful flapping-wing machine has ever been built, so far as we are aware. This type of machine is known as an ornithopter. Several experimenters are working at ornithopter machines, however, with encouraging results.

New Books, Etc.

NATURAL PHILOSOPHY. By Wilhelm Ostwald. New York: Holt & Co., 1910. Price, $1.

In these days of highly specialized science, it seems strange to pick up a book, even by so distinguished a scientist as Ostwald, bearing the old-fashioned and indeed obsolete title, "Natural Philosophy." Curious as it may seem, the analytical methods which gave us the many sciences which arose out of the old "natural philosophy" have led us back again into the paths of synthesis. So many are the separate sciences, that there is realy a need to record them all from a general point of view, to link with each other, to show how one has borrowed from the other, and above all, to find the connection between one's own activity and the work of mankind in its totality. No better man than Ostwald could be found to perform this task of unification. He is probably the best all-around scientist of our time, although primarily a chemist.

SHOP KINKS. By Robert Grimshaw, M.E. New York: The Norman W. Henley Publishing Company, 1911.

Mr. Grimshaw, the author of this book, is a well-known contributor to American technical periodicals as well as the SCIENTIFIC AMERICAN. The rather heterogeneous but highly useful "kinks" of which this book is composed have appeared for the most part in various publications, among them the SCIENTIFIC AMERICAN, and are here collected into a book which, in our opinion, will undoubtedly win a place for itself in the library of every shop mechanic. Mr. Grimshaw has prepared an excellent index, which facilitates the handling of his book.

PHYSICS. By Charles Riborg Mann and George Ransom Twiss. Chicago: Scott, Foresman & Co., 1910.

This book is written according to a method of treatment that develops the subject as a source of problems. Of recent years the method has come to be recognized as one of great pedagogic value. The difficulty, however, is to frame the problems in such a fashion that they really become scientifically significant to the pupil. With that end in view, the authors have rewritten the first edition of their book and given us the present revised edition. The work is divided into two parts. The first contains the material that should be significant to everybody; the second contains the material that may be needed by those that are going to work in scientific professions, and considerable other material which many teachers desire to place before their pupils. This division of the subject into two parts renders it possible to give to the pupils a really instructive course in physics. Moreover, those who go on will be able to master the whole subject better if they take it in the order given, because the more abstract and difficult problems come toward the end.

EXTINCT MONSTERS AND CREATURES OF OTHER DAYS. By Rev. H. N. Hutchinson, B.A. London: Chapman & Hall, Ltd., 1910.

This is the second and enlarged edition of a work which has deservedly earned an enviable place in popular scientific literature. Combining his previously issued "Extinct Monsters" and "Creatures of Other Days," the author has given us a very readable and withal an accurate account of paleontology, and particularly of that branch of paleontology which has been developed so wonderfully in this country under Prof. Henry Fairfield Osborn. There are of course a few inaccuracies, which are inevitable, particularly in a popular book. The only one of these, however, that deserves comment is an error in the restoration of Stegosaurus.

THE COMING OF EVOLUTION. By John W. Judd. Cambridge: The University Press, 1910.

Even in these days of Mendelism, Darwin's is a name to conjure with. Probably no scientific theory has exerted so deep an influence on scientific progress as the doctrine of evolution. Any book in which the great Englishman's teachings are set forth with simplicity and accuracy is bound to command attention. It would have been difficult indeed to select a man more competent to perform this service of popularization than Prof. Judd. He has seen the theory of evolution itself evolve. In other words, he has seen it grow from a hotly attacked principle, which was regarded as wildly visionary, into a theory that has played a most important part in modern biology.

HEREDITY. By L. Doncast r, M.A. Cambridge: The University Press, 1910.

For a small book, this certainly presents very clearly the leading principles of heredity. The author has dealt with the more modern developments of the subject, and has avoided speculative questions. The author has presented, to our mind, in a very fair way just what the principles of heredity are in the light of modern research, and has avoided the more controversial aspects of the question.

A Great Zoological Park

(*Continued from page 11.*)

provided with open-air ranges, surrounded by steel posts, steel wire and concrete foundations, to inclose the herds of bison, elk, wild sheep, wild goats, ibex, and deer of all kinds. Of the open-air installations for wild mammals and birds, several are very elaborate and costly; such as the Bear Dens and the Flying Cage. Of all the thirty buildings in the Zoological Park, the most important single feature is the elephant house, which is fittingly crowned with a dome. It is situated on the axis of Baird Court, in the open space midway between the Court and the Wolf Dens.

In effect it connects the two great groups of installations of the northern and southern regions of the park, which heretofore have been slightly separated. It is spacious, well lighted, beautiful in its lines, both externally and internally. The Elephant House, unlike all other buildings in the park, is entered at the center of each side, instead of at each end. It is built entirely of stone, having a main roof of green tiles, and a lofty dome covered with glazed tiles, laid in an elaborate colored pattern of browns and greens. The dome is finally surmounted by a lantern of tile work, also in colors. Excepting the dome, the whole exterior structure is of smoothly dressed Indiana limestone. Each of the eight cages is 20 x 24 feet, and the lighting is quite perfect. The Elephant House contains a fine and valuable collection, consisting of two Indian elephants, two Soudan African elephants, one Congo African elephant, one great Indian rhinoceros, one African black rhinoceros, one hippopotamus, two American tapirs, and one Indian tapir. The hippopotamus, son of the famous "Caliph," now six years old, born in the Central Park menagerie and purchased for three thousand dollars, is the chief attraction, for besides his comfortable lounging and sleeping room, he is provided with a luxuriant bathing pool.

THE COLLECTION OF AMERICAN MAMMALS.

Of North American mammals exhibited, the carnivorous species are very numerous. First in importance comes a fine series of bears. It is natural that people should desire first of all to become well acquainted with the wild life of their own land. The great bear collection is installed in a series of large open-air dens, having clean yards, plenty of sunlight, fresh-water bathing pools, rocks to climb upon, companionship, with a plentiful supply of good food. The animals are consequently full of action, and provide a great amount of amusement for the people.

From the beginning, the park has striven to bring together as many as possible of the species of bears with which the public is little acquainted. First, special attention was devoted to the Alaskan brown bears, and to-day the park possesses five species—the Kadiak, Peninsula, Yakutat, Admiralty, and one other. The as yet undetermined species came from north of the Arctic circle, only three hundred miles south of Point Barrow (the most northerly point of Alaska), which is the most northerly habitat for a bear of this group. The magnificent monster "Ivan" (*Ursus gyas*) from the Alaska Peninsula is the rival of the largest polar bear in captivity, and beside him the largest polar bear seems small. "Ivan" is the undisputed king of the bear colony, and from his colossal size, and being full of good humor, he is one of the greatest attractions to visitors. The zoological value of the park's bear collection cannot be equaled elsewhere, for it is stated that all the bears in Europe added together would not make a collection zoologically equal to these seventeen species, representing nearly forty individuals. Of the remarkable giant brown bears of Alaska, not a single specimen is to be seen in all Europe. The Polar Bear Den, with its deep and spacious swimming pool, natural rock background and caves, is considered one of the finest in the world.

A new and noteworthy exhibit is the herd of five young musk-ox calves recently received from Ellsemere Land, Greenland, the gift of Paul J. Rainey. "Miss Melville," the first specimen, arrived a year ago from Melville Island. These six constitute the only live herd of these rare animals in captivity.

ANIMALS FROM ASIA AND AFRICA.

The wild-animal representatives from Asia are second only to those of Africa in size and zoological richness. The prize specimen from Asia is the great Indian "rhino," considered one of the greatest zoological wonders left alive upon this earth. Conspicuous also is the Indian elephant, the Malay tapir, half black and half white; the big, hairy, double-humped bactrian camel, with its baby male, born this year. Of the wild equines of Asia, there are three important species, the Prejevalsky horse (breeding here), the kiang of Tibet, and the Persian wild ass. Asia furnishes a number of species of mountain sheep and the ibex. The Persian ibex is exhibited in the park, and is thriving. The long-haired, wind-blown tahr of the Himalayas is the hardiest of all the mountain animals of Asia, that has been attempted to acclimate here. One of the most showy of the wild white mountain goats of the world, with gigantic spiral horns, is the markhor, frequenting great elevations in the Himalayas of India. Of the Asiatic antelopes, the park possesses three of the rare and beautiful snow-white beatrix from the Arabian desert, the very large but well-nigh hornless nilgai of India, the beautiful little Dorcas gazelle of Arabia, and the Indian gazelle of the plains of northern India.

Of the many carnivores of Asia, the snow leopard is the rarest of the larger forms, and also the most beautiful. Next in rarity and beauty also is the clouded leopard.

Next to North America, Asia is the continent best supplied with bears. There are exhibited six species. These are the Himalayan black bear, the hairy-eared bear from central Asia, the Malay sun bear, the Japanese black bear, the great Yezo bear of Japan, and buff-colored Syrian bear from Asia Minor.

Zoologically, Africa contributes the greatest number of species of commanding importance. The wild representatives of the Dark Continent in themselves form a highly impressive caravan. These include a pair of Soudan elephants with enormous ears, the pigmy west African elephant of the French Congo, a pair of black rhinoceroses, a hippopotamus, a wart-hog and the Red River hog, the latter being the only "beautiful" swine species in the world. Of the wild equines, there is the mountain zebra, rarest of all species (only 400 now alive); the Grevy zebra, one of the largest, and in some ways the most remarkable, the Grant zebra and Chapman's.

The antelopes include a fine male sable antelope, a greater kudu, and Baker's roan antelope, three species of great rarity and value, and the eland, largest of all African antelopes. Among the other rare antelopes are the lechee, the addax, the beisa, Congo sitatunga, Speake's sitatunga, bontebok, blesbok, and rendunca. The only specimen representing the group of Duiker antelopes was presented by ex-President Roosevelt. Among the commanding African mammals are the fine pair of Nubian giraffes from German East Africa. They cost $5,500. The male stands fourteen feet six inches in height, and the female over twelve feet. The pair form the most imposing figures of the Antelope House.

Now that the Zoological Park is practically complete, the society desires to carry on more vigorous and extensive work in the protection of the fast-vanishing wild life and the promotion of zoology. Among the important questions to be taken up is that of preventing the threatened destruction of our marine fauna, especially the whales and seals.

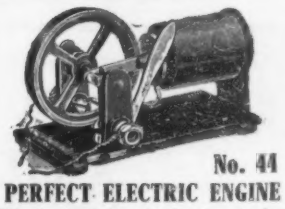
THERMOS
The Necessity For Every Motorist's Comfort
No automobile is completely equipped without Thermos. On the long trip or the short spin Thermos is indispensable for your party's comfort.
Thermos will pay for itself the first trip out.
Thermos keeps any liquid or solid hot without fire or cold without ice until ready for use. Whether you travel or in your everyday life at home, your comfort requires Thermos. It is especially valuable in the sickroom or nursery, and handy in the office or factory.
You cannot appreciate how greatly Thermos adds to your comfort until you read the little thirty-four page booklet full of interesting facts describing every Thermos article herewith illustrated. It is free upon request.
If you are a dealer and not selling Thermos—send for catalogue and discounts.
Thermos is sold by all good stores, but for your own sake avoid worthless imitations. Look for the name "Thermos" on every Thermos article.
American Thermos Bottle Co.
THERMOS BLDG. NEW YORK

Your Choice of these Three Premiums with One Year's Subscription to
POPULAR ELECTRICITY MAGAZINE For $1

1-2 SIZE

No. 55 MAGAZINE POCKET SCREW DRIVER

The need and usefulness of this tool will be instantly recognized. There is nothing just like it or that can be compared with it in the market today. It is made with four detachable blades of varying widths and thicknesses to suit different size screws. The blades are kept in magazine formed by handle. The tool is small and convenient to carry in the pocket, measuring when closed only 3 inches long and 5-8 inch in diameter, and weighing only two ounces.



No. 44 PERFECT ELECTRIC ENGINE

This attractive electric engine, three times size shown in illustration, built on scientific principles. Runs 1,000 revolutions a minute on one dry battery. Has a speed control and reversing lever. Amusing and instructive for you and your friends.

No. 99 Screw Driver Knife

Twice size illustrated.

Combines all purposes of screw driver and pocket knife. Handsome hardwood handle; well tempered, keen edge blade, strong enough to cut wire; screw driver end. Closes like pocket knife; locks when open. Can not shut down on the hand while in use. A very handy and useful tool for all purposes.

Why Don't You Read Up On Electricity?

Haven't you often thought, "I must read up on electricity; I'm ashamed not to know what's **wait."** Thousands are saying that, and it's for them and you **POPULAR ELECTRICITY** is published. A high-class monthly magazine, plumb full of interest to **everybody.** Not a bit technical—yet all electrical men want it—but written in Plain English, delightfully entertaining and instructive, with 100 illustrations each issue. Keeps you posted on all electrical events. Shows how to perform interesting experiments, make and use electrical devices. "wireless" apparatus, etc. Full of hints on business economy and efficiency. Helps and interests the ladies. **Junior Section** delights the boys. Gives yours a chance. He may be a future Edison. **Wireless Club Membership Free to Readers;** electrical questions answered free, with many other privileges. Special offer, $1.00 a year (Canada $1.35, foreign $1.50), including **the premium you select.**

POPULAR ELECTRICITY MAGAZINE, 441 Commercial Building, CHICAGO

ABSOLUTELY FREE
A 5 Vol. Set of MAUPASSANT

Illustrated — 4½ x 7 inches. Bound in Art Cloth.

Each volume contains more than 300 pages.

You are NOT to pay anything for the set NOW nor AFTER you receive it

AN unexpected transaction has enabled us to add a few thousand subscribers to our magazine. We believe that it is good business to let you have these sets of DE MAUPASSANT ABSOLUTELY FREE in order to get you started. The price of PEARSON'S MAGAZINE is 15 cents a copy, which, if purchased by single copies, costs $1.80 a year. For boxing, wrapping and express charges on the five volumes of DE MAUPASSANT, *150 complete stories*, illustrated, printed from new large type, copyrighted 1910, size 4½ x 7, it costs an average of 80 cents each, according to distance; so send us $2.60 for the year's subscription to the magazine and for the absolute cost of shipping and delivery.

NO FURTHER CHARGES OF ANY KIND

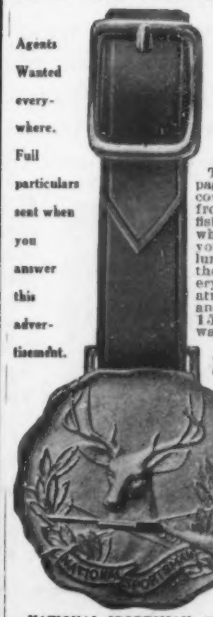
You may send only 70 cents, as good faith, and the books will be shipped you, with the Special Privilege of Examination, before you pay the balance (the express companies charge 10 cents more for these collect shipments); or send the full amount at once and save 10 cents. Send us $2.60 in money, stamps, check or money-order. If the books are not satisfactory in every way, without quibble or question, we will refund you either the 70 cents or $2.60 paid.

Guy De Maupassant's eventful career in Paris gave him ideas, situations and local color for his unsurpassed stories. Strong in imagination, overflowing with natural enthusiasm and passion in his study of human life and phases of human conduct, things really happening—not as we imagine they might or as we would—**BUT THE REAL DOINGS OF LIFE**—is what Maupassant always gives us. His dramatic instincts, his situations, and his climaxes are overwhelming. These absorbing stories should be in every library—**tales of travel, mystery, adventure, comedy, pathos and tragedy, love and realism. You must Write AT ONCE.**

PEARSON'S MAGAZINE
432 East 24th Street, New York City

IF YOU LIKE HUNTING, FISHING, CAMPING,

Agents Wanted everywhere. Full particulars sent when you answer this advertisement.



You will like the
NATIONAL SPORTSMAN

This magazine contains 100 pages or more, crammed from cover to cover with photos from life, stories of hunting, fishing, camping and tramping which will thrill and interest you. This monthly visitor will lure you pleasantly away from the monotonous grind of everyday work to the healthful atmosphere of Field, Wood and Stream. Single copies 15c. Yearly subscription with watch fob, **$1.00.**

Special Trial Offer

Send us 25 cents, stamps or coin, and we will send you the National Sportsman for **3 months,** also one of our heavy burnished Gold Watch Fobs (regular price 50c.) as here shown, with russet leather strap and gold-plated buckle. Also a copy of our new 32-page illustrated premium list.

NATIONAL SPORTSMAN, 65 Federal St., Boston, Mass.

250 Pages of Inventory Figured in One Evening

John B. Geijsbeek, Certified Public Accountant, Denver, Colo., says: "Not long ago I was asked to verify the extensions and additions on a 250 page inventory of one of the commercial enterprises of this city. A year before I did this same work and it took me fully three days with one assistant. This year I sat down to it with one of my assistants after supper one evening and we finished it with a Comptometer a little after midnight."

Such results are possible because of the Comptometer's unequaled speed on all kinds of figuring—multiplication and division as well as addition.

Light, portable—not a fixture—can be carried from one department to another under your arm.

Write for descriptive booklet "Rapid Mechanical Calculation," or machine sent on free trial, charges prepaid, U. S. or Canada.

Comptometer
ADDS MULTIPLIES DIVIDES SUBTRACTS

FELT & TARRANT MFG. CO.
1706 North Paulina Street CHICAGO, ILL.

THE "BEST" LIGHT

"Makes and burns its own gas. Pure white 500 candle power light, more brilliant than electricity or acetylene, and cheaper than kerosene. Casts no shadow. Costs two cents per week per lamp. No dirt, no grease, no odor. Used in every civilized country on earth. Over 200 styles. Every lamp warranted. Agents wanted. Write for catalog.

THE BEST LIGHT CO.
37 E. 5th St., Canton, O.

BRIGHTEN UP Your Stationery in the OFFICE, BANK, SCHOOL or HOME by using WASHBURNE'S PATENT PAPER FASTENERS.

75,000,000
SOLD the past YEAR should convince YOU of their SUPERIORITY.
Trade O. K. Mark
Made of brass, 3 sizes. In brass boxes of 100.
Handsome. Compact. Strong. No Slipping. NEVER!
All stationers. Send 10c for sample box of 50, assorted sizes. Illustrated booklet free.
The O. K. Mfg. Co., Syracuse, N. Y. No 1B

"RANGER" BICYCLES

Have imported roller chains, sprockets and pedals; New Departure Coaster-Brakes and Hubs; Puncture Proof Tires; highest grade equipment and many advanced features possessed by no other wheels. Guaranteed 5 yrs.

FACTORY PRICES direct to you are less than others ask for cheap wheels. Other reliable models from $12 up. A few good second-hand machines $3 to $6.

10 DAYS' FREE TRIAL We ship on approval, freight prepaid, anywhere in U. S., without a cent in advance. DO NOT BUY a bicycle or a pair of tires from anyone at any price until you get our big new catalog and special prices and a marvelous new offer. A postal brings everything. Write it now.

TIRES Coaster Brake Rear Wheels, lamps, parts, and sundries half usual prices.

Rider Agents everywhere are coining money selling our bicycles, tires and sundries. Write today.

MEAD CYCLE CO., Dept. T 175, CHICAGO

TYPEWRITERS ALL MAKES

Visible Writers or otherwise
Olivers, Remingtons, Smiths, etc.
Shipped ANYWHERE for Free Trial, or RENTED, allowing RENT to APPLY.
Prices $15.00 up
First class Machines fresh from the Manufacturers. Write for Illustrated Catalog 10. Your opportunity.
TYPEWRITER EMPORIUM (Est. 1892), 92-94 Lake St., Chicago.

TYPEWRITERS SLIGHTLY USED
Your chance to get standard machines, including visibles, at ½ to ⅔ original price. Guaranteed good as new. No. 2 Smith-Premier only $20.00, No. 6 Fay-Sholes $15.00 Cash.—Privilege of examination. We also sell on installment plan or rent, rental applied on purchase. Send for catalogue to-day.
Rockwell-Barnes Co., 919 Munn Bldg., Chicago.

Wizard Repeating LIQUID PISTOL

Nickel-plate 3 in. long. Pat'd

Will stop the most vicious dog (or man) without permanent injury. Perfectly safe to carry without danger of leakage. Fires and recharges by pulling the trigger. Loads from any Liquid. No cartridges required. Over six shots in one loading. All dealers, or by mail, 50c. Rubber-covered Holster, 10c. With Pistol, 55c. Money-order or U. S. stamps. No coins.
PARKER, STEARNS & CO., 298 Sheffield Avenue, Brooklyn, N. Y.

This publication is printed with INK manufactured by
CHAS. ENEU JOHNSON & CO.
45 AND 47 ROSE STREET, NEW YORK
OFFICES
Philadelphia, St. Louis, Chicago, Cleveland

PRINT for YOURSELF

Cards, circulars, book, newspaper. Press $5. Larger $18. Rotary $60. Save money. Print for others, big profit. All easy, rules sent. Write factory for press catalog, type, cards, paper. THE PRESS CO., Meriden, Conn.

BOUND VOLUMES OF
AMERICAN HOMES and GARDENS
1310 Illustrations 1910 492 Pages, Price $5

¶ American Homes and Gardens is beautifully printed and is handsomely bound in silk finished cloth covers, printed in three colors, with gilt edges. The year's volume contains 492 pages and over 1300 engravings, which are as full of detail and finish as actual photographs. They depict the most notable homes in America as well as historic mansions, the modest house and bungalow, the most beautiful gardens and the more simple ones.

¶ The edition deals with every appointment of the home; it treats of the decorating of the walls, the furnishing of the draperies for the doors and the windows, the suitable furniture for the hall, living room, dining room, library, kitchen, bedroom, bathroom and porch; the landscape work about the house and the garden with all its accessories.

SPECIAL NOTICE: On request we will send you a list of contents of the 1910 volume.

A limited number of the back bound volumes are available, viz.: 1906, 1907, 1908, and 1909. Price $5.00 each. 1905 volume, $3.50.

¶ MUNN & CO. Inc. Publishers
361 Broadway, New York

An endowment fund of $1,000,000 is to be raised, which will enable the society to do effective work in this field. Already much work has been done in the matter of game refuges. Through its officers the society has been instrumental in the establishment of the Wichita National Bison Range, having presented fifteen pure-blood bison from the park's herd to the National government, which, with the Montana National Bison Range, on the Flathead Reservation, will secure for all time the continued existence of the American bison.

The Professional Inventor

(Continued from page 16.)

coal on a large scale. During an earlier period of the country's history, Pennsylvania and Ohio were the great iron-producing States, and plants for smelting iron ore were established there, adjacent to the mines. With the depletion of these ore beds and the opening up of other and richer deposits elsewhere, notably in the Lake Superior region, it became necessary to bring in larger and larger amounts of ore from long distances; and by reason of the increased cost of the delivered ore, the smelting plants in the old territory became threatened with extinction. To save this situation, the inventive labors of a group of men were applied to the economical shipment and handling of the ore *en route* from the new fields. At the water terminals on the Great Lakes enormous electric-motor operated ore-handling plants were erected, capable of transshipping the cargo of an arriving vessel (itself especially built to be an integral part of the system) into freight cars in a marvelously short time with the minimum amount of labor. Inventive talent here was distinctly not of the old, single-handed kind, bent merely on "making an invention"; on the contrary, it was of a higher order, in that it directed a masterly campaign to build up a new system for saving on cost of delivery of ore, reducing the cost of handling the ore from 40 cents a ton by the old hand method to less than 4 cents, including interest and depreciation on plant. Its accomplishment was a score or more of the well coördinated inventions which revived one of the greatest industries of the Keystone and Buckeye States.

In one type of ore-handling plant, a steel structure is erected at the water side, with scoop-bucket cranes carried by traveling bridges and working direct upon the cargo through numerous large hatches in the deck. By powerful motors controlled by men on the upper levels of the bridges or on "man-trolleys," the ore is scooped up from the hold of the vessel, swung over into a bridge car, and thence dumped directly into freight cars standing on tracks below or into a large storage space covered by the bridges. The system permits exceedingly rapid movement of the handling machinery. For example, the two ore-handling bridges of the Carnegie Steel Company at Youngstown, Ohio, have a span of 250 feet, travel at the rate of 150 feet per minute, and can in a single twelve-hour day stock 181 cars with an average weight of 40 tons of ore.

A striking instance of great saving in a manufacturing process by a detail improvement is the Gayley dry blast for blast-furnace operation, which was put into service six years ago (August 11th, 1904). In this process the air required for combustion is deprived of the greater portion of its moisture by cooling it far below the dew point before blowing it into the furnace. The humidity of the entering air is thereby rendered low, and nearly constant, under all variations of climatic or atmospheric conditions. The process is also applicable to smelters generally, and to the Bessemer converter, cupolas and open-hearth furnaces, and copper converters.

This invention is an improvement in an ancient art, made by day-by-day observation of blast-furnace work. Before it was made, an unexplained mystery in iron smelting was that the quality of iron produced, and the amount of coke required to smelt the ore, varied to an extent that could not be accounted for by variations in the grade or composition of the ore or coke, or by leaks in the tuyeres which might cause variation in the amount of air admitted. Mr. Gayley, by cultivating an intimate acquaintance with the atmosphere, found the correct and ready reason in the natural variation in the humidity of the air from day to day. He found that this variation is many times greater than the variation in the constitution of the raw materials charged into the furnace, and he considered this fact in connection with the fact that a greater weight of air is used for every ton of iron produced than of solid raw materials. The water blown into a given blast furnace in the form of water vapor naturally present in the air varies from 1-1/3 gallons to 8 gallons per minute, according to the degre of atmospheric humidity. This steam, in chemically dissociating in the furnaces, absorbs so much heat as materially to cool the smelting zone or hearth. The blast furnace has a critical temperature below which it will not smelt the ore; and since the temperature of combustion is only a little above this point, the importance can be realized of eliminating this objectionable cooling effect, and especially the natural variation with change in the weather. Dry air, obtained by powerful refrigerating machines forming part of the blast-furnace equipment, has strengthened the weak link in the chain of combustion processes that goes on in the furnace by increasing the heat available at the hearth, thereby increasing the duty of the hearth 12 per cent.

By this simple change in blast-furnace operation, the result of definite engineering inventive work, marked savings in raw materials are effected. The record of a typical furnace showing an increase of output of about 26 per cent, with decrease in coke charged of about 13 per cent. But further than this, very valuable improvement is effected by reducing waste of ore dust, ordinarily carried away by the blast; by reducing the power required in the blowing engines; in the ability to use cheap, high-phosphorus ores, and in the precision of operation of the furnace and the securing of iron of uniform grade and composition.

The facts just cited summarize the new order of things in the world of invention. Manufacturing takes the lead as the primary interest, and inventing becomes one of its activities, but not less important by the change. The individual solitary worker, often laughed at as a dreamer, though occasionally revered, has given place to the professional inventor, one of an organized group of skilled workmen or trained engineers, a man who usually keeps regular hours, draws a regular salary, and attacks definite manufacturing problems with no less energy for being businesslike.

Breeding Successful Strains of Basket Willows

A farmer in one of the middle States grew a crop of basket willows on 60 acres which brought him $10,000, a yield at the rate of $166 an acre. The average crop in a region of best growth usually brings less than one-half this amount. The strain and manner of cultivation made this noteworthy difference. The splendid crop grown by this up-to-date farmer was raised from carefully selected cuttings obtained from the best stock of neighboring basket-willow plantations, where these strains are thoroughly adapted to the local soil and climate. The soil is among the best, though not any better than that of a good many other plantations which yield a much smaller crop of less valuable rods. Willow growers often blame the soil for not producing a crop as large as it should, and as a matter of

Home-Made Experimental Apparatus

¶ In addition to the following articles, the SCIENTIFIC AMERICAN SUPPLEMENT has published innumerable papers of immense practical value, of which over 20,000 are listed in a carefully prepared catalogue, which will be sent free of charge to any address. Copies of the SCIENTIFIC AMERICAN SUPPLEMENT cost 10 cents each.

¶ If there is any scientific, mechanical, or engineering subject on which special information is desired, some papers will be found in this catalogue, in which it is fully discussed by competent authority.

¶ A few of the many valuable articles on the making of experimental apparatus at home are given in the following list:

¶ **1584.—How a Tangent Galvanometer Can Be Used for Making Electrical Measurements.**

¶ **1615.—The Construction of an Independent Interrupter.** Clear diagrams giving actual dimensions are published.

¶ **1618.—An Easily Made High Frequency Apparatus Which Can Be Used to Obtain either D'Arsonval or Oudin Currents.** A plunge battery of six cells, a two-inch spark induction coil, a pair of one-pint Leyden jars, and an inductance coil, and all the apparatus required, most of which can be made at home.

¶ **1363 and 1381 Simple Wireless Telegraph System.**

¶ **1622.—The Location and Erection of a 100-Mile Wireless Telegraph Station** is clearly explained with the help of diagrams.

¶ **1623.—The Installation and Adjustment of a 100-Mile Wireless Telegraph Outfit,** illustrated with diagrams.

¶ **1624.—The Making and the Using of a Wireless Telegraph Tuning Device,** illustrated with diagrams.

¶ **1546.—How to Make a Magic Lantern.**

¶ **1555.—The Construction of an Eddy Kite.**

¶ **1561.—The Demagnitization of a Watch** is thoroughly described.

¶ **1594.—The Making of a Rheostat.**

¶ **1494, 1049 and 1406. Good Articles on Small Water Motors.**

¶ **1472.—How an Electric Oven Can Be Made.**

¶ **1433. The Building of a Storage Battery.**

¶ **1210.—A Sewing Machine Motor (Electric) of Simple Design.**

¶ **1595.—A Wheatstone Bridge.**

¶ **1514, 1522 and 1527.—Good Articles on Induction Coils.** Full details are given so that the coils can readily be made by anyone.

¶ **966.—How to Make a Telephone.**

¶ **1527.—A Model Steam Engine** is thoroughly described.

¶ **1561, 1563 and 1566.—How to Make a Thermostat.**

¶ **1500 and 1554.—Aneroid Barometers.**

¶ **1464.—A Water Bath.**

¶ **1562.—A Cheap Lathe Upon Which Much Valuable Work Can Be Done.**

Each number of the SCIENTIFIC AMERICAN SUPPLEMENT costs 10 cents by mail.

Order from your newsdealer or from

MUNN & CO., *Inc.*,
361 Broadway, - - - New York.

fact the soil selected is very often not suitable. Many farmers are under the impression that willows should be planted in undrained soils, which is a serious mistake. Soil that yields a good crop of wheat also produces a good crop of willows under proper cultivation. The successful basket-willow grower considers the selection of suitable soil as only one of the requisites for growing a profitable crop of rods. The proper selection and care of cuttings for planting will insure an enormously increased yield, and in many cases actually double it, provided the willows are properly cultivated so as to keep weeds down and the soil loose. Selected cuttings are of prime importance. The value of selection has long been recognized in the analogous case of seed in all our common agricultural crops.

The willow is among the most plastic of all our woody plants, and is easly propagated by means of cuttings. The ancestry of a certain strain of basket willow is as vital as it is in the higher animals. Its characteristic qualities are quite readily transmitted from year to year, and all varieties are susceptible to further improvement. The investigators have even more control over the successful propagation of selected varieties of willow than they do in cases of fruit trees or other farm crops, since a new crop of selected cuttings can be obtained every year from the preceding year's planting. Carefully conducted experiments in selecting and breeding certain varieties of basket willows will result in strains of entirely modified characteristics in less than ten years. Four strains have been developed out of the American green willow (*Salix amygdalina L.*), of which one is said to be entirely immune to the destructive willow rust. A number of strains have been developed from the common purple willow, all of which have their particular virtues in certain soils.

The basket willow is a farm crop of increasing importance on both sides of the Atlantic, and the country that develops the most desirable strains is the one to control the supply of the market. At present European countries have a decided advantage over the United States. We cannot introduce strains developed in Europe and expect them at once to do as well here as they do in the locality where they originated. An Iowa grower introduced the common white willow (*Salix vinimalis L.*) from Europe, with the hope of producing as fine a crop of rods as this willow is wont to yield in its native country. With considerable expectation he waited for the remarkable crop he was going to produce, but the harvest showed him the danger of using cuttings not suited to his soil and climatic conditions. There are about ninety different varieties and hybrids of basket willows that are successfully grown in Europe. In this country there are but four kinds that are yielding good returns, and only one of those is especially well suited to the lake States. Not a single variety has been found that can be grown successfully in the southern States.

The desired improvement should be brought about by continually selecting certain rods from normal stools of a variety that is most likely to yield to judicious treatment. To develop or to accentuate a specific quality which the bulk of rods are now lacking is the most important consideration for the American willow culturists. Slender, cylindrical, flexible, and tough rods are sought by the best basket makers, and so long as the American farmer is unable to raise a sufficient quantity of this sort, the manufacturers will buy their raw material in Europe. Consequently, the domestic rods will sell at a very low figure. Better strains of willows for local use will have to be developed, just as certain strains of farm crops have come to be recognized as suitable for local use. Because of the future importance of the industry and the strength of foreign competition, a rapid development in the quality of American grown rods is essential. This much-desired improvement of the basket willow in the United States can be brought about by continually selecting cuttings from the shoots having the desired qualities. Since such strains are not as a rule susceptible to general adoption, it will be necessary to develop different ones for different localities.

In certain portions of Pennsylvania, Maryland, Ohio, and Kentucky, the American green willow is seriously affected with a willow rust which destroys the leaves prematurely, and consequently the shoots die. This disease was first discovered in Maryland and Pennsylvania, and later it appeared in Ohio, and now is reported from Kentucky. A wide-awake farmer in the latter State observed that a certain strain of American green is very rarely affected by this rust. He concluded at once that this is an immune variety, which he is now successfully raising. This rust seriously affects the character and value of the rods. If the rods are not killed outright, they usually become so brittle near the top that the basket maker is unable to use them.

Farmers who wish to start a plantation of basket willows should not buy a large number of cuttings by faith. There are nurseries springing up here and there, and the proprietors claim that they can furnish cuttings of all the best varieties known to willow culturists. The fact is that some of these nurserymen do not know the correct names of the willows they have for sale, nor do they know for what localities their varieties are best suited. Unless the farmer can buy selected cuttings from his neighbor, he is likely to be at the mercy of the dealer living at a distance, since he may not see the stock until it arrives on his farm. Although basket-willow breeding cannot be followed in the scientific sense by the farmer, selecting cuttings from the shoots on the stump and propagating them is a simple matter, and can be practised by any farmer. Testing certain strains, continuing the best kinds, and discarding the inferior ones are still less formidable. Basket-willow growing should be a matter of sentiment, and the farmer should have a desire to see them grow under the best of care and cultivation. Unless the farmer does grow the best strains and put his heart into the work, he is not worthy of the meager results he does obtain.

Studies of the Aurora

(*Concluded from page 10.*)

eter and 2 inches focal length. He made 800 photographs, about half of which were successful. The aurora was photographed simultaneously from two stations, nearly three miles apart, which were connected by telephone. This made it possible to determine the heights of the bands and streamers, which were found to range from 30 to 125 miles. As the atmosphere at these elevations is composed almost entirely of nitrogen, it is not surprising that the bright lines of the auroral spectrum are nitrogen lines. In view of the satisfactory results which Stoermer has obtained with exposures of a fraction of a second, it seems not unlikely that the aurora will soon be captured by the kinematograph. At all events a systematic application of Stoermer's method will secure data of great importance for the study of the aurora and will explain many points which are now uncertain.

The New Cunarder.—The latest reliable information from England gives the length of the new Cunarder as 885 feet on deck; the beam as 95 feet 6 inches; the total displacement as 50,000 tons; the speed as 23 knots, the number of passengers carried as 2,790, and the total cost as ten milion dollars.

6% GOLD BONDS

Re-invest Your January Funds At 6 Per Cent.

¶ Have your investments afforded satisfactory return, security and convertibility? Then consider the American Real Estate Company's 6% Gold Bonds before re-investing your dividends or savings.

¶ A-R-E Six's are the direct obligations of the American Real Estate Company, and are based on its immense holdings of New York City real estate.
¶ New York real estate's tremendous advance shows its investment possibilities, and this Company has been conspicuously successful in its operation therein. It has returned to investors more than $5,000,000 without loss or delay.
¶ In the further development of its business the Company offers its 6% Gold Bonds in these convenient forms:

6% COUPON BONDS
For those who wish to invest $100 or more.

6% ACCUMULATIVE BONDS
For those who wish to save $25 or more a year.

¶ We shall be glad to serve you as we have served others. Full information sent on request.

American Real Estate Company
Founded 1888 :: Assets, $15,536,199.47
Capital and Surplus - - $1,851,154.38
Room 627 527 Fifth Avenue, New York

WEAK SIGNALS EASILY READ with our new WIRELESS Variable Condenser
Tunes out unwanted signals. Price, tubular type, $2.50. Send 2c. for catalogue. ETHERIC ELECTRIC CO., 21 Barclay St., New York, N. Y.
Price, $2.50

Nulite Gasoline Table Lamp
A beautiful lamp for homes, hotels, offices, stores, banks, cafes. Portable, safe; can be turned upside down or relied on the floor without danger or affecting the light. 300 C. P. of soft, brilliant light, one-third cent per hour. Also 200 different styles of lamps and systems.
AGENTS—We want town, county, and traveling salesmen. Best proposition ever offered. Sells everywhere. Write for Special Offer.
CHICAGO SOLAR LIGHT CO.
212 So. Jefferson Street CHICAGO

AIR GAS! Latest Invention.
Standard Vacuum Gas Machine makes gas automatically! Uses 97% ordinary air! Cheapest, safest, most hygienic for lighting, heating and cooking! All conveniences of city gas, without any of its drawbacks! Non-poisonous, non-asphyxiating, inexplosive and inodorous! Machine always ready! Gas can be made for 15c. per 1000 cu. ft.! 25 times cheaper than acetylene! Cheaper than kerosene lamps, electricity or city gas! Saving will pay for the machine in a few months! Agents wanted everywhere in the United States and abroad!
Standard-Gillett Light Company
9 N. Michigan St., Chicago, U.S.A.

Incorporate Your PATENTS and BUSINESS in ARIZONA
Laws the most liberal. Expense the least. Hold meetings, transact business anywhere. Blanks, By-Laws and forms for making stock full-paid for cash, property or services, free. President Stoddard, FORMER SECRETARY OF ARIZONA, resident agent for many thousand companies. Reference: Any bank in Arizona
STODDARD INCORPORATING COMPANY, Box 3000
PHOENIX, ARIZONA

YOUR GILLETTE BLADES
Can be resharpened hundreds of times and made better than new with a Gaylor Stropper.
Price, postpaid, $1.00. Circular free.
Gaylor Automatic Stropper Co. - Stamford, Conn.

SOUTHERN STAMPING & MFG. CO.
Manufacturers of special and patented articles.
R. 8., Nashville, Tenn.

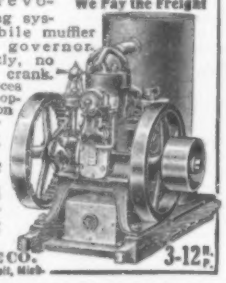
AIRCRAFT
The World's Great Magazine of Aerial Flight
A Collection of Issues Makes a Complete Aeronautical Encyclopedia
Edited by Experts under the General Supervision of Alfred W. Lawson
Accurate Construction Work a Special Feature
Complete Records and Statistics
New Flyers Described
Details of Model Building
Illustrations from every Quarter of the Globe
Recent numbers contain articles by such famous men as: H. A. Toulmin, Counsel for the Wright Brothers; Israel Ludlow, Counsel for Paulhan; Clément Ader, Louis Paulhan, Robert Esnault-Pelterie, Louis Blériot, George F. Campbell Wood, Denys P. Myers, Edward H. Young, S. P. Langley, Hudson Maxim, Sir Hiram Maxim, A. Lawrence Rotch, General James Allen, Glen Curtiss, Chas. K. Hamilton, Claude Grahame-White, etc., etc.
After January first the subscription rate will be $1.50 per year.
Prior to that date it will be $1.00 per year
Single copies, 15 cents
THE LAWSON PUBLISHING COMPANY
37-39 E. 28th St., New York, U. S. A.

ELLIS ENGINES USE KEROSENE

For Farm, Shop and Home

Runs perfectly on kerosene, gasoline, distillate, any fuel oil. Hundred less parts. Patent throttle gives three engines for price of one. Single spark ignition saves 75% battery cost. Force feed lubricator—perfect oiling. Double duty tank revolutionizes cooling systems. Automobile muffler. Ball bearing governor. Starts instantly, no pre-heating, no crank. Experience unnecessary. Women can operate. Mounted on skids or trucks. Vibration eliminated. Comes complete, tested, ready to run. Twice as good at half the price.

We Pay the Freight



3-12 H.P.

Free Trial

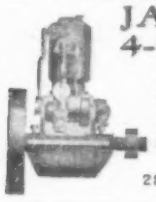
No obligation till satisfied. 10-year guarantee. "Engine Facts" free; write for it NOW.

ELLIS ENGINE CO. 22 Mullett St., Detroit, Mich.

A CHEAP WATER POWER

Farmers and others who live in the country will be interested in our new catalogue, describing the wonderful NIAGARA HYDRAULIC RAM and showing how easy and cheap it is to have running water in house and barn. Write for catalog A-k

NIAGARA HYDRAULIC ENGINE CO., 140 Nassau St., New York; Factory: Chester, Pa.



JAGER Marine 4-Cycle Engines

Skillfully designed and well built. Single lever control, combining automatic carburetor with spark advance. Develops wide speed range and reliability under most trying conditions. Sizes 3 to 60 h. p. Send for catalog.

CHAS. J. JAGER CO. 281 Franklin, cor. Batterymarch St. Boston, Mass.

BARKER MOTORS

Reliable.—1¼ to 10 H. P.—Economical

Their perfect operation and reliability are due to common sense mechanical ideas and good construction. While low in price, they are made of best materials with careful attention to details.

C. L. BARKER, NORWALK, CONN.

4 H.P. STATIONARY GASOLINE ENGINE COMPLETE $76.00

12 H.P. $219

For Farmwork, Irrigation or Pumping, Factory use and Electric Lighting.

3 to 20 h. p.—perfectly governed-guaranteed by a responsible firm. Write for particulars.

GRAY MOTOR CO. 121 Leib St., DETROIT, MICH.

Ideal Lawn Mower Grinder

1911 MODEL NOW READY

Better than ever before. Ball-bearing Main Shaft and Grinding Wheel. Grinds all makes of Mowers perfectly in 15 minutes without removing wheel or ratchets. SEND TO-DAY for full description of this wonderful labor-saver and money-maker. Will more than pay for itself first season because it does the work so much quicker and better. Over 5,000 in use. Fully warranted.

DON'T DELAY

HEATH FOUNDRY & MFG. CO.

PLYMOUTH, - OHIO.

DO YOU USE GRINDSTONES?

If so we can supply you. All sizes **mounted** and **unmounted**, always kept in stock. Remember, we make a specialty of selecting stones for all special purposes. *Send for catalogue "L"*

The CLEVELAND STONE CO. 6th Floor, Hickox Bldg., Cleveland, O.

HELMET OIL LUBRICATES ANYTHING SEND FOR SAMPLE FREE

118-124 North Clinton St. CHICAGO, U.S.A.

MODELS & EXPERIMENTAL WORK. Inventions developed. Special Machinery. E. V. GAILLARD CO., 24 Frankfort Street, New York.

Experimental & Model Work

Cir. & advice free. Wm. Gardam & Son, 221 Fulton St., N.Y.

M. P. SCHELL MFG. CO., Manufacturers of Special Machinery, Patented Devices, Metal Articles, Tools and Dies. Gear Cutting, Punching Work. Models and Experimental Work. 509-511 Howard Street, San Francisco, Cal.

MODELS CHICAGO MODEL WORKS ESTABLISHED 1887 470 S. WACKER DRIVE CHICAGO, ILL.

INVENTORS Let us build your model before you apply for a patent. Advice free. G. Schwarz & Co., 123 Liberty St., New York

SETS OF CASTINGS OF MODEL ENGINES GEAR WHEELS & PARTS OF MODELS

MECHANICAL SUPPLIES and MATERIAL of all kinds. EXPERIMENTAL AND LIGHT MACHINE WORK to order. 133 MILK STREET, BOSTON

CRUDE ASBESTOS DIRECT FROM MINES

PREPARED ASBESTOS FIBRE for Manufacturers use

R. H. MARTIN, OFFICE, ST. PAUL BUILDING 220 B'way, New York.

Science

Hail Insurance.—The extent to which hail insurance is carried abroad is indicated by the report made at a recent annual meeting of the Nurseryman, Market Gardens, and General Hailstorm Insurance Corporation, in England, that the area of glass insured in that country now amounts to 37,700,000 square feet.

An Island Swallowed by the Sea.—The Island of Illopango Lagoon, Salvador, disappeared on December 17th after a series of earthquake shocks and slid into the depths of the lagoon, carrying with it nearly all of the inhabitants. At least seventy families, numbering all told about 170 men, women, and children, were engulfed.

A Bargain in Radium.—The director of the English Radium Institute, Mr. Alton, recently went to Vienna to purchase a gramme of radium from the Austrian government. Mr. Alton represented Sir Ernest Cassel, who is willing to defray the expense. The price will be about $70,000 for a gramme, which is considered cheap.

What Money Can Do for Science.—Prof. Karle Schwarlschild, in a recent number of the International Wochenschrift, comments on the triumphs of American astronomers. After paying a tribute to the thorough work of American astronomers, he points out how wonderfully they have been helped by their excellent equipment and endowment. He finds that five of the greatest American observatories have among them $250,000 annually at their disposal, while the ten leading German observatories together have only $87,500.

Studies of Carbon.—The investigations of British scientists have brought out some curious observations about carbon and the astonishing relation of its properties to the geometrical figure known as the tetrahedron, a solid bounded by four equilateral triangles. It is said that the completeness with which the fundamental properties of the carbon atom are symbolized by a regular tetrahedron is altogether astounding. That atom, it appears, has four affinities, which operate practically in the direction of the four radii, proceeding from the center toward the four solid angles of a tetrahedron. In the future, it has been remarked, when the archæologist of the time shall dig for signs of our life, he will find the tetrahedron and the benzene hexagon among the mystic symbols that he will have difficulty in interpreting. If, like the ancient Egyptians, we made our tombs records of our wisdom, such symbols would long since have acquired sacred significance.

Work at Mt. Weather.—The report of the Chief of the Weather Bureau for 1910, just published, gives prominence to the aerological investigations carried out at Mt. Weather Observatory. During twelve months there were only nine days on which kite or balloon ascents were not made, owing to adverse conditions of one kind or another. Free sounding balloons cannot be used at Mt. Weather, owing to the proximity of the ocean to the leeward, but the observatory staff has made successful use of these instruments at Fort Omaha, Neb., and Indianapolis, and on one occasion reached an altitude of fifteen miles. Among the interesting results already attained is the fact that the stratification of the lower portion of the atmosphere, as regards its temperature and moisture, is more extensive than was hitherto suspected. There are many exceptions to the rule of decrease of temperature with altitude; thus a great layer of warm air is sometimes found floating upon a layer of cold air. It may be remarked, in this connection, that the stratification of the atmosphere has also been noted and discussed recently by European investigators—especially Wegener and Süring—and is one of the most interesting developments of aerology.

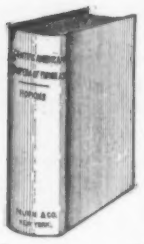
JUST PUBLISHED

The Scientific American Cyclopedia of Formulas

The Most Complete and Authoritative Book of Receipts Published

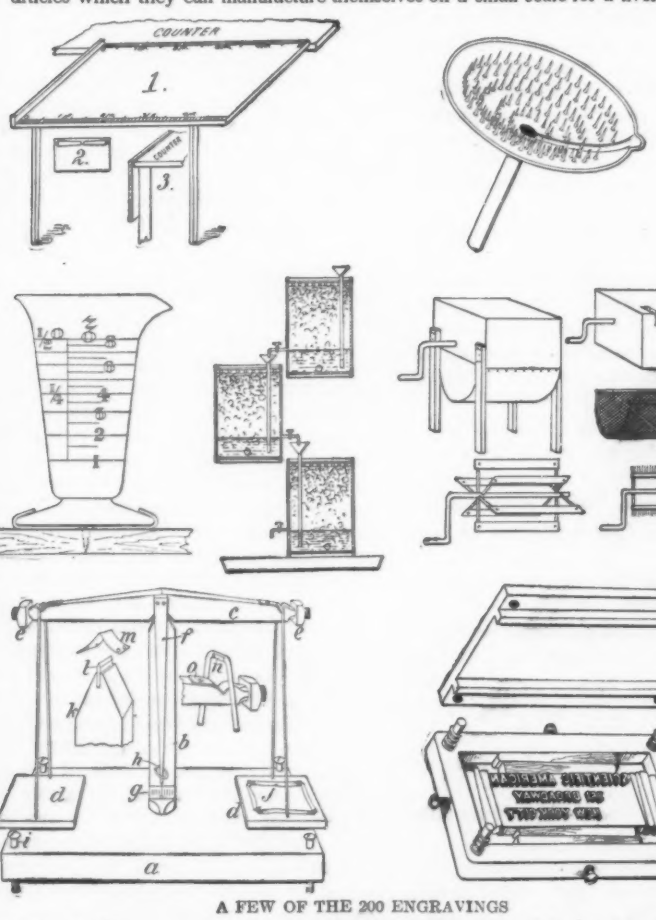
Partly Based on the Twenty-Eighth Edition of "The Scientific American Cyclopedia of Receipts, Notes and Queries"

Edited by **ALBERT A. HOPKINS,** Query Editor of the Scientific American



THIS is practically a ***new book*** and has called for the work of a corps of specialists for more than two years. Over 15,000 of the most useful formulas and processes, carefully selected from a collection of nearly 150,000, are contained in this most valuable volume, nearly every branch of the useful arts being represented. Never before has such a large collection of really valuable formulas, useful to everyone, been offered to the public. The formulas are classified and arranged into chapters containing related subjects, while a complete index, made by professional librarians, renders it easy to find any formula desired.

¶ An entirely new departure in a book dealing with receipts, is the chapter on Chemical, Pharmaceutical and Technical Manipulation, which has been prepared with the aid of well-known chemists. The information contained in this chapter is entirely practical and a careful study of it will go far in saving the expenditure of both money and time. There is also a list of prices of odd, out-of-the-ordinary technical products, which is a very valuable feature and is also unique. Many useful tables are also included. This book will prove of value to those engaged in any branch of industry and contains hundreds of the most excellent suggestions for the many thousands who are seeking for salable articles which they can manufacture themselves on a small scale for a livelihood.



A FEW OF THE 200 ENGRAVINGS

"As Indispensable as a Dictionary and More Useful"

Following is a List of the Chapters:

Accidents and Emergencies.
Agriculture.
Alloys and Amalgams.
Art and Artists' Materials.
Beverages; Non-Alcoholic and Alcoholic.
Cleansing, Bleaching, Renovating and Protecting.
Cements, Glues, Pastes and Mucilages.
Coloring of Metals, Bronzing, etc.
Dyeing.
Electrometallurgy and Coating of Metals.
Glass.
Heat Treatment of Metals.
Household Formulas.
Ice Cream and Confectionery.
Insecticides, Extermination of Vermin.
Lapidary Art, Bone, Ivory, etc.
Leather.
Lubricants.
Paints, Varnishes, etc.
Photography.
Preserving, Canning, Pickling, etc.
Rubber, Gutta-Percha and Celluloid.
Soaps and Candles.
Soldering.
Toilet Preparations, including Perfumery.
Waterproofing and Fireproofing.
Appendix: Miscellaneous Formulas; Chemical Manipulation; Weights and Measures; Index.

SEND FOR DETAILED PROSPECTUS

Octavo (6½ x 8¾ inches), over 1,000 Pages, 200 Illustrations
Price, in Cloth, $5.00, Net. Half Morocco, $6.50, Net, Postpaid

MUNN & COMPANY, *Inc.* :: :: :: *Publishers*
SCIENTIFIC AMERICAN OFFICE, 361 Broadway, NEW YORK

Classified Advertisements

Advertising in this column is 75 cents a line. No less than four nor more than 12 lines accepted. Count seven words to the line. All orders must be accompanied by a remittance. Further information sent on request.

READ THIS COLUMN CAREFULLY.—You will find inquiries for certain classes of articles numbered in consecutive order. If you manufacture these goods write us at once and we will send you the name and address of the party desiring the information. There is no charge for this service. **In every case it is necessary to give the number of the inquiry.** Where manufacturers do not respond promptly the inquiry may be repeated.

MUNN & CO., Inc.

FOR SALE.

Inquiry No. 9173.—Wanted, manufacturers of machinery for removing fibre (coir) from cocoanut husks.

FOR SALE.—Patent No. 547,581. Issued Dec. 20, 1910. Always Ready Windrow Baling Press. Mexican Patent No. 10349. For particulars address Inventor, Jacob Barens, Altus, Arkansas.

Inquiry No. 9175.—Wanted, manufacturers of a machine called Beiasco or Biasco, used in the manufacture of ostrich feathers.

FOR SALE.—International Correspondence School course of study exchangeable for any other they teach. John E. Alden, 802½ Spruce Street, Seattle, Wash.

Inquiry No. 9188.—Wanted, manufacturers of rubber block tires for one ton trucks.

WANTED.

Inquiry No. 9190.—Wanted, name and address of parties who make for sale pattern letter moulding machines and matrix.

LOCAL REPRESENTATIVE WANTED.—Splendid income assured right man to act as our representative after learning our business thoroughly by mail. Former experience unnecessary. All we require is honesty, ability, ambition and willingness to learn a lucrative business. No soliciting or traveling. This is an exceptional opportunity for a man in your section to get into a big-paying business without capital and become independent for life. Write at once for full particulars. Address E. R. Marden, Pres., The National Co-Operative Real Estate Company, 378a Marden Building, Washington, D. C.

Inquiry No. 9202.—Wanted, to buy the Rose fountain pen.

WANTED.—Solicitors or salesmen to obtain signatures to petitions asking Congress to enact a Parcels Post law. Experienced parties furnishing proper references make good pay. Address Postal Progress League, No. 125 East 23rd Street, New York.

Inquiry No. 9207.—Wanted, names and addresses of firms making star section iron and steel suitable for lightning rods.

LISTS OF MANUFACTURERS.

Inquiry No. 9208.—Wanted, the address of the manufacturer of the "Little Giant" Pump.

COMPLETE LISTS of manufacturers in all lines supplied at short notice at moderate rates. Small and special lists compiled to order at various prices. Estimates should be obtained in advance. Address Munn & Co., Inc., List Department, Box 773, New York.

Inquiry No. 9209.—Wanted, names of owners of gold placer properties.

SALE AND EXCHANGE.

Inquiry No. 9210.—Wanted, names of owners of deposits of pumice or volcanic ash.

A LIST OF 1,500 mining and consulting engineers on cards. A very valuable list for circularizing, etc. Price $15.00. Address Munn & Co., Inc., List Department, Box 773, New York.

Inquiry No. 9211.—Wanted, addresses of parties who can ship ore containing vanadium, molybdenum, or bismuth.

Inquiry No. 9212.—Wanted, names and addresses of owners of fluor spar properties.

Inquiry No. 9213.—Wanted, addresses of parties making Viscol compound for shoes or shoes made from leather treated therewith.

Inquiry No. 9214.—Wanted, address of maker of "Piako," a fastening for ladies' dresses.

Inquiry No. 9215.—Wanted, machine for producing a good finish on hammer and other handles.

Inquiry No. 9216.—Wanted, to buy a sewing machine having a very long arm for special work.

Inquiry No. 9217.—Wanted, the names and addresses of manufacturers of machinery for shelling almonds and peanuts.

Inquiry No. 9218.—Wanted, the names and addresses of manufacturers of outfits for salting almonds and peanuts.

Inquiry No. 9219.—Wanted, names and addresses of manufacturers of bags, cartons, and oiled and waxed paper for marketing salted almonds and peanuts.

Inquiry No. 9220.—Wanted, the names and addresses of manufacturers of plants for the preparation and mixing of baking powders; also dealers in ingredients for making the powder, manufacturers of cans, labels, etc., for packing baking powder for the market.

Inquiry No. 9221.—Wanted, names and addresses of owners of mica properties.

Inquiry No. 9222.—Wanted, names and addresses of owners of white silica sand deposits.

Inquiry No. 9223.—Wanted, to buy machinery for making sugar of milk.

Inquiry No. 9224.—Wanted, to buy a motor driven floor scrubbing machine.

Inquiry No. 9225.—Wanted, a concern able to grind and polish hammers.

Inquiry No. 9226.—Wanted, to buy a machine for making flat-sided popcorn cakes.

Inquiry No. 9227.—Wanted, a power-driven saw for cutting down pine trees twenty inches in diameter.

Inquiry No. 9228.—Wanted, to buy fabric tufting machines.

Inquiry No. 9229.—Wanted, addresses of manufacturers of an alloy called Duraluminum.

STEAM TURBINES.—THEIR CONstruction, Operation and Commercial Application. SCIENTIFIC AMERICAN SUPPLEMENTS **1306, 1307, 1308, 1422, 1400, 1447, 1370, 1372.** The articles have all been prepared by experts in steam engineering. Price 10 cents each, by mail Munn & Co., 361 Broadway, New York City, and all newsdealers

For Heavy Sewing
Harness, canvas, straps, gloves, shoes. Wonder mending awl with lock stitch. $1 prepaid. *Agents wanted.* Ask for Book J.
C. A. Myers Co., 6316 Lexington Ave., Chicago

THE SCHWERDTLE STAMP CO.
STEEL STAMPS, LETTERS & FIGURES
BRIDGEPORT CONN.

Electricity

Wireless in Court.—During the hearing of the case of Marconi vs. the British Radio Telegraph and Telephone Company, in the King's Bench Division, London, the judge and lawyers will have practical demonstrations, permission having been granted for the conversion of the court into a "wireless" operator's office. Messages will be sent and received. The arrangements will be carried out under the superintendence of Prof. Boys.

New Power Plant for the Boston Elevated.—The Boston Elevated Railway Company is about to build a large power plant at South Boston. Two turbo-alternators of 15,000 kilowatts each will be installed, but provision will be made for a further increase should the next Legislature permit the suburban trolley systems to come under the control of the company. A large coal plant, with a capacity of a hundred thousand tons, will be provided.

Cost of Electrification.—The cost of electrifying the main and suburban lines within fifteen miles of Boston has been estimated at $32,751,942, of which six million represents the cost of the generating system of 60,000-kilowatt capacity, and nearly four million the cost of the transmission lines and overhead system. The outlay for electric locomotives is placed at a little under seven million, and it is estimated that the multiple-unit motor cars will cost a trifle more. The multiple-unit trail cars will cost about five million. This covers the electrification of the New Haven and the Boston and Maine lines, with 461 miles of track, and a daily service of 14,630 train miles.

Water Storage versus Storage Battery.—A writer in the London Electrician suggests that it would be more economical to use water storage in power plants in place of storage batteries, the idea being to provide motors for pumping water when the load is light, and to use these motors as generators driven by Pelton wheels during the peak load. To illustrate the advantage of such a system, he assumes the case of a 10,000-kilowatt plant with a spare plant of 2,500 kilowatts in the form of lead storage batteries, steam generators, for his proposed water storage. By providing a shaft of a thousand feet with a reservoir of 14,160 cubic yards at the bottom of the shaft, he concludes that the capital cost of the water system would be $130,000, and annual charges $11,100, as against $160,000 capital and $20,975 annual cost for storage batteries, and $187,500 capital and $21,500 annual charges for steam.

Wireless Storm Warnings.—On November 1st the Deutsche Seewarte, at Hamburg, inaugurated a system of storm warnings and daily weather bulletins by wireless telegraphy, covering the North Sea and the Baltic. Whenever a storm warning is issued that applies to the North Sea it is telegraphed three times from the wireless station at Norddeich, while similar messages referring to the Baltic are sent out from the station at Bülk. The same warnings are repeated either at 1 P. M. or 11 P. M., and are then sent slowly; this is for the benefit of small craft which are not able to maintain a constant wireless service and whose inexperienced operators would have difficulty in receiving a message sent at ordinary speed. A weather report, describing the state of wind and barometer over Europe as shown by the morning weather map, is sent out with the daily time-signal telegraphed from Norddeich at 1 P. M. The number of small German fishing vessels equipped with wireless apparatus is rapidly increasing, and it is proposed that the imperial government shall contribute to the expense of installing such apparatus on many vessels not yet equipped. This will be done upon the condition that the vessels thus favored shall undertake to receive all storm warnings, and disseminate them among the shipping generally by means of ordinary optical signals.

Engineering

Commerce Destroyers "Minneapolis" and "Columbia."—It is proposed by Chief Constructor Watt to transform the swift and once famous commerce destroyers "Columbia" and "Minneapolis" into "mother ships for submarine boats." He proposes to remove about two-thirds of the boiler power, and two of the three engines in each ship, thus making them economical in operation.

Grand Prize for Brennan.—The authorities of the Japan-British Exhibition in London have awarded to Louis Brennan for his gyroscopic monorail invention the Grand Prize, which is the highest award given in connection with this exhibition. The Brennan gyroscopic car was the first car of practical dimensions to maintain its equilibrium while running upon a single rail.

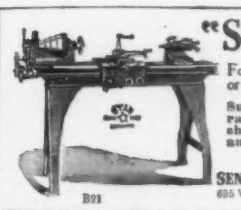
High-Speed Steam Yacht.—America is the home of the high-speed steam yacht. Among notable vessels are the 25-mile "Niagara IV.," and "Vixen II.," the 27-mile "Vitesse I.," the 32-mile "Little Sovereign," and the 33-mile "Vitesse." There is now being built from the design of Mr. Charles L. Seabury a steam yacht "Sovereign," 165 feet over all, driven by twin screws, for which the builder has guaranteed a speed of 35 miles an hour.

The Most Dangerous Occupation.—According to the Insurance Age, the work of railroad trainmen is not the most dangerous occupation. It seems that the highest percentage of fatality is found among the fishermen of Gloucester, Massachusetts, where it is nearly twelve per cent of the total number employed. For the decade ending in 1907, the mortality percentage among railway men was about 8 per cent. The number of deaths due to accidents of occupation among all wage earners annually is between thirty and thirty-five thousand; the non-fatal accidents exceed two millions.

World's Iron Supply.—In the course of a recent address on geology and economics, Prof. Kemp, of Columbia University, did not share the pessimistic view of Carnegie and others as to the early failure of the world's iron supply. He considers that, at the present rate of output and percentage of yield, there is an assured supply in this country for about a century. In view of the deposits known to exist in Cuba, Newfoundland, Brazil and elsewhere, and the probability of discoveries of other deposits elsewhere, he estimates that the world's supplies when fully opened up will prove sufficient to last for fifteen hundred years.

The Canal Should Be Fortified.—Referring to the necessity for fortifying the Panama Canal, The Army and Navy Journal suggests a situation, in which a war has broken out on the Pacific and our ships, concentrated in that ocean, have met with a disastrous defeat. The approaches to the canal being in the hands of the enemy, the Gulf and Atlantic coasts would be in a state of panic lest his fleet, passing through the canal, in a few hours would be off a great southern or eastern port. Were the canal impregnably fortified, forty days would intervene before the enemy could reach New York by way of the Strait of Magellan.

Terminal Docks at Staten Island.—The ambitious scheme to provide a vast terminal at Staten Island for the New York State barge canal has recently been brought into prominence by the visit of an influential committee to view the site. The location selected on the south shore of the island is admirably adapted for the purpose, the bottom being suitable for the foundations of the piers, which are to be 1,500 feet in length, and the main channel lying adjacent to the proposed pierhead line. The time is coming when sites for further extensions of docking facilities will have to be sought away from Manhattan Island, and the site in question seems to be one of the best, if not the best, along the shore line of New York Harbor.


"Star" Large line of Attachments
For Foot or Power **Lathes**
Suitable for fine accurate work in the repair shop, garage, tool room and machine shop.
Send for Catalogue S
B21
SENECA FALLS MFG. CO.
695 Water St., Seneca Falls, N.Y.

THE SEBASTIAN 15-INCH ENGINE LATHE
HIGH GRADE LOW PRICE
Automobile Builders, Garages, Repair and General Jobbing Shops find this the ideal lathe for their work. Catalog free.
The Sebastian Lathe Co., 120 Culvert St., Cincinnati, Ohio

WORK SHOPS
of Wood and Metal Workers, without steam power, equipped with
BARNES' FOOT POWER MACHINERY
allow lower bids on jobs, and give greater profit on the work. Machines sent on trial if desired. *Catalog Free.*
W. F. & JOHN BARNES CO.
Established 1872.
1999 Ruby St. Rockford, Ill.

GROBET Swiss Files
and other tools shown in "The Tool-Monger." This 375-page catalog mailed on receipt of 6 cents in postage stamps.
MONTGOMERY & CO., 109 Fulton Street, New York City

Learn Watchmaking
We teach it thoroughly in as many months as it formerly took years. Does away with tedious apprenticeship. Money earned while studying. Positions secured. Easy terms. Send for catalog.
ST. LOUIS WATCHMAKING SCHOOL, St. Louis, Mo.

MASON'S NEW PAT. WHIP HOISTS
save expense and liability incident to Elevators.
Adopted by principal storehouses in New York & Boston
Manfd. by VOLNEY W. MASON & CO., Inc.
Providence, R. I., U. S. A.

RUBBER Expert Manufacturers Fine Jobbing Work
PARKER, STEARNS & CO., 288-290 Sheffield Av., B'klyn, N.Y.

ICE MACHINES Corliss Engines, Brewers' and Bottlers' Machinery. THE VILTER MFG. CO., 899 Clinton St., Milwaukee, Wis.

Magical Apparatus.
Grand Book Catalogue. Over 700 engravings
25c. Parlor Tricks Catalogue, free.
MARTINKA & CO., Mfrs., 493 Sixth Ave., New York

To American Manufacturers. Having an established business 15 years standing desire to represent American manufacturers in different lines, best bank references. Urlainis Bros., Rostow on Don, Russia.

I WANT THE MAN who knows good architecture to send for "HOMES OF CHARACTER"

A choice collection of designs of over 40 houses, bungalows and cottages—$1,000 to $10,000. All *new practical* plans, with *concise* descriptions and *cost* of plan for each house. Just the book you want if you intend to build. $1 prepaid. Sample pages, 2c
JOHN HENRY NEWSON, Architect,
1253 Williamson Bldg., Cleveland, Ohio

MEN Wanted
COMMENCEMENT SALARY $800.
United States Government wants Railway Mail Clerks, Custom Clerks, Internal Revenue Employees. Several thousand appointments from Spring examinations. Annual vacation, short hours. Salary is sure. No "layoffs." Common education sufficient. Candidates coached free. Write immediately for schedule of Spring examinations. Franklin Institute, Dept. E139, Rochester, N. Y.

LEARN TO WRITE ADVERTISEMENTS EARN $25 to $100 A WEEK
We can positively show you by mail HOW TO INCREASE YOUR SALARY. Book mailed free. PAGE DAVIS, Dept. 89, Chicago, Ill.

About Remembering
By ELBERT HUBBARD

HENRY DICKSON
America's foremost Authority on Memory-Training and Principal Dickson School of Memory.

FOR a long time I have been promising myself to write up my good friend, Mr. Henry Dickson of Chicago, and I have not forgotten.

Mr. Dickson is teaching a Science or System, which I believe is of more importance than the entire curriculum of your modern college.

MR. DICKSON teaches memory. Good Memory is necessary to all achievement.

I know a man who is a graduate of three colleges. This man is neither bright, interesting nor learned. He's a dunce.

And the reason is that he CAN NOT REMEMBER. He can not memorize a date or a line of poetry. His mind is a sieve.

Education is only what you remember.

Every little while I meet a man who has a memory, a TRAINED MEMORY, and he is a joy to my soul.

The manager of a great corporation never misses a face. If he sees you once the next time he will call you by name. He told me how he did it. He studied memory-training with Prof. Dickson. He said a lot of nice things about Prof. Dickson, that I hesitate to write here lest my good friend Dickson object.

This Dickson system of memory-training is very simple. If you want to enlarge your arm, you exercise it. The same with your mind. You must put your brain through a few easy exercises to discover its capacity You will be surprised, how quickly it responds.

You do not know when you will be called upon to tell what you know; and then a trained memory would help you. To the man or woman whose memory plays tricks, I recommend that you write to Prof. Dickson, and if his facts do not convince you, you are not to be convinced.

Write today for FREE booklet and facts. Address
PROF. HENRY DICKSON
700 AUDITORIUM BUILDING, CHICAGO

AN ADDRESS TO OUR READERS

THE MAN who christened The Scientific American little realized how *scientific* the *American* of the future would be. As it happens, "science" has become the watchword of the Twentieth Century.

Americans are peculiarly a scientific people. Their advance has been along the line of invention applied to great resources of nature. The Scientific American, founded sixty-five years ago, keeping step with the scientific development of this country, has become to-day the official organ of those people who really do things, and who want to know what others are doing.

Just as older countries have added to the world's art, literature and music, this country has added to its science, invention and industrial progress. The publication that has most carefully recorded these great discoveries is the most necessary publication to the average intelligent, progressive American.

No adventure of the past is so great as the adventure which ultimately will lead to the conquest of the air, to driving enormous tunnels under great rivers, to sending telegrams without wires, to all those great phases of invention and discovery which have raised the strength of man's puny arm to the nth power.

Ten years ago a tunnel under the Hudson River was a visionary dream. To-day you can be whirled underneath this river in rapid, well-lighted, clean trains through any one of several tubes. In a very short time the two great continents of America will be sawed in two. This enterprise, please bear in mind, attempted by another nation, is being accomplished by ours.

It is because such things are natural to the temperament of the average American that his logical magazine is The Scientific American. What it has done well in the past it will do better in the future.

The history of the rise of the automobile is already found in its pages from the first tentative experiments down to the wonderfully sure and beautifully designed machines of to-day. What has happened in the automobile industry is now happening in the field of flying, and when this is finally accomplished its history will be written in The Scientific American by the men who knew—not an outside reporter's account, but an inside scientific man's account.

You want to attend an aviation meeting with a definite understanding of the difference between a Wright biplane and a Blériot monoplane. You can if you will. The regular reader of The Scientific American is in close touch, not merely with the theory of flying, but with its different applications. He is just as far along as the men who are doing it. He understands the problems, and he looks upon each successive advance with the intelligent comprehension of the stage manager behind the scenes—not with the mystified wonder of the man in the parquet seat.

This, then, is the ambitious program of The Scientific American; to be what it has always been, but widened and broadened and deepened because its field is widening and broadening and deepening.

Beginning with the current number each issue of The Scientific American will have four additional pages, except that once a month in the so-called monthly issue it will have many more pages than the regular issue and will be enclosed in a colored cover. This is to afford more room to cover the subjects which have become necessary because the field in which The Scientific American stands alone has been growing so rapidly. It will be a paper made better by circumstances.

Sixty-five years ago The Scientific American picked out its own particular field in journalism. It was alone in that field then and it is alone in that field to-day, while that field is nevertheless one of the most important, if not *the* most important, to every citizen of this country.

Its editors are trained men—trained in their respective lines. These men are in touch with all the men working in different fields of work who are best fitted to express in simple but exact words the progress of each department of human endeavor. The Scientific American will be the authority; it will be the first news as well as the most complete news of any new development.

We do not know what the next ten years will bring forth. We do not even know what the next ten months will bring forth. We do not know what daring conception approaching actual application may be in progress next year as aviation is in progress this year. We do not know what will take the place of the automobile ten years from now, but we do know that whatever it is The Scientific American will present it to its readers by picture and text so graphically that every reader will feel that he was present at its inception, witnessed its progress and triumphed in its completion.

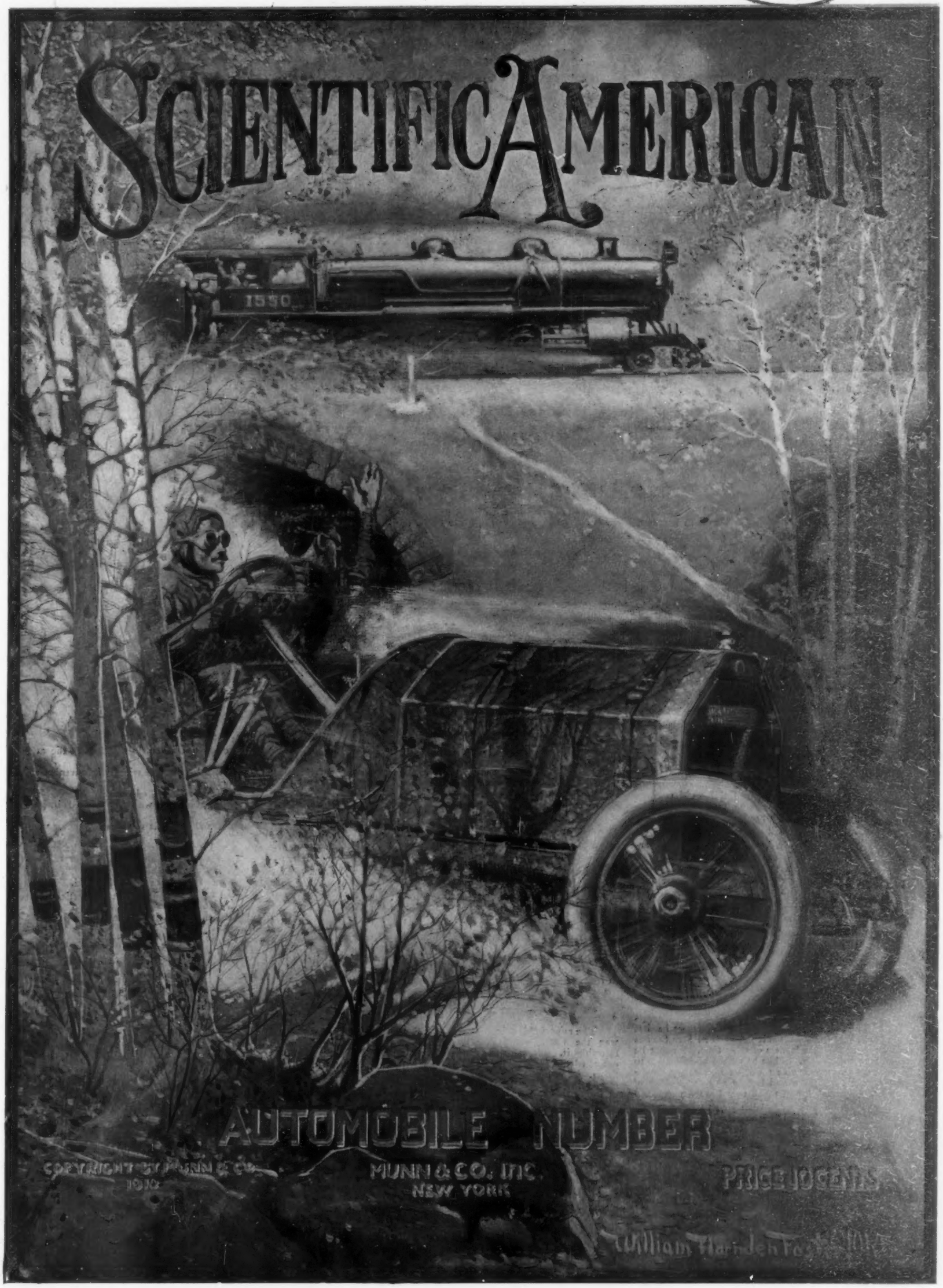
THE PUBLISHER.

JAN 12 1911

PUBLIC LIBRARY
OF THE
CITY OF DETROIT

M

SCIENTIFIC AMERICAN



AUTOMOBILE NUMBER

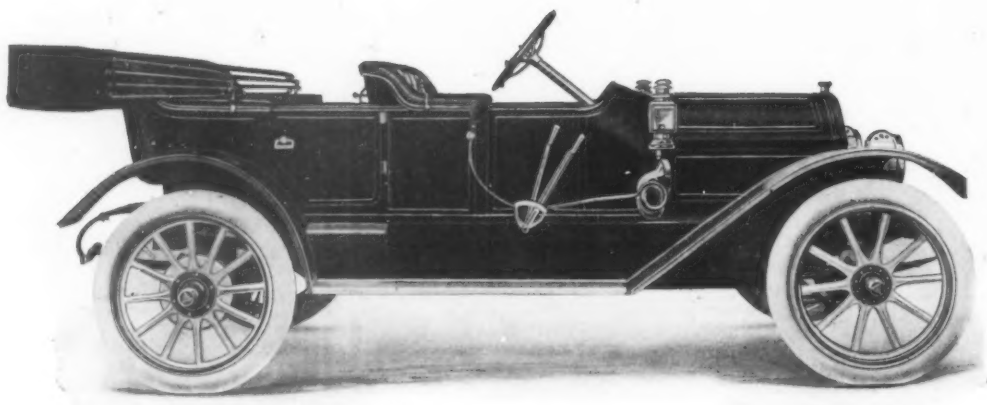
MUNN & CO. INC.
NEW YORK

COPYRIGHT BY MUNN & CO.
1910

PRICE 10 CENTS

HUDSON "33"

"33" Touring Car $1250



"33" Pony Tonneau $1300

The "33" Torpedo $1350

Equipment on all models includes 3 oil and two gas lamps, horn, tools, pump, quick detachable rims, gas generator.
Mohair Top, Prest-O-Light tank instead of gas generator and Duplex system ignition, with famous Bosch high Tension Magneto, $150 extra for either model.

687 Sold the First Day

Reserve Your Hudson Now

The first days' sales made to individuals by Hudson dealers—on the day when the new HUDSON "33" arrived—totaled 687 cars.

Three-quarters of a million dollars worth of automobiles sold the first day!

There has not been a day since, that orders for immediate delivery were not far in excess of our output. At this writing—in midwinter with a large section of the country covered with snow—we have unfilled orders for more cars wanted at once than we can produce in a month.

Judge what the demand will be in the spring.

You will see the necessity if you want this car, of arranging a delivery date now.

Dealers cannot be given more cars than have already been arranged for. We are in fact, compelled to reduce some of the allottments made for early delivery.

Our whole output was taken by dealers before the first car was shipped. Some dealers had sold half the cars they had arranged for before they had received a demonstrator.

The over supply of low-priced cars last summer may have led some to think that good cars will be plentiful. But remember that the over supply was of old model cars, displaced largely by the announcement of Howard E. Coffin's latest design—the new HUDSON "33".

Howard E. Coffin is known for the successes he has produced wherever automobiles are used. The four famous cars he designed were the leaders of their time. At first he designed high-priced cars. Then he turned his attention to building a car that would give the same satisfactory service—that has the same grace and beauty and fine quality of materials, workmanship and finish that has been expected only of those selling at $2,000 and up.

The HUDSON "33" is his masterpiece.

Desirable cars are difficult to obtain when they are wanted.

You who wait until spring comes will surely find this condition. The most desirable cars will be sold far in advance.

The six leading makers, in all probability, will find it impossible to make prompt deliveries on all orders in May and June.

If you intend buying a car, begin your investigation at once and assure yourself of delivery when you want it. There will be no change in models or price.

Even cars that ordinarily have small demand, will be in large demand in spring.

By taking your car now you can get three months' extra use without extra cost.

A 1910 car driven 15,000 miles can be sold if you desire, with less sacrifice than a 1909 model used only half as much.

Therefore get your 1911 model early. It can be resold in the fall to as great an advantage as if it were delivered in May.

The Coincidence of the "33"

The remarkable thing about the HUDSON "33" is the way the latest models of the greatest European Cars resemble it. Leading Engineers of Europe have just exhibited their newest designs at the Paris Automobile Show. Such famous makes as the Renault, Fiat, Mercedes, Isotta, Lancia, De Dietrich, Martini and many others, show identically the same ideas that Mr. Coffin, working independently of the European masters, put into the HUDSON "33".

Simplicity the Keynote

Simplicity is evident in every detail.

The number of parts used is 900 less than in the average car.

Oiling places can be reached without inconvenience or soiling the clothing.

Moving parts are all enclosed and dust-proof. This includes the valve mechanism, which is exposed in practically all American cars.

The frame is heavier than is used on any other car of its weight.

The motor and transmission are held together as a unit, giving all the advantages of both the three and four point system of suspension.

Wheels are stronger than are ordinarily used.

Springs are so designed that they are practically unbreakable, yet are easy and flexible.

There is greater leg room in the front seat than is provided in most cars.

The steering wheel is extra large—same as on the biggest, costliest cars.

Don't these facts make you want to see the HUDSON "33"?

Think what it means to obtain for $1250 the masterpiece of such an engineer as Howard E. Coffin.

Think what it means to obtain a car at that price that embodies the ideas that the leading European Engineers are this year putting on their cars, anyone of which sells for from three to five times the price of the HUDSON "33".

Then think what is indicated by the 687 orders taken the first day.

Doesn't that look as though it would be hard to get prompt delivery of a HUDSON "33" in the spring?

Therefore reserve your HUDSON now.

Write for complete detailed descriptions and address of your nearest dealer.

See the Triangle on the Radiator

HUDSON MOTOR CAR COMPANY

5061 Jefferson Avenue, DETROIT

LICENSED UNDER SELDEN PATENT

New Automobile Prices

Revolutionizing Motor Car Standards

THE United States Motor Company announces a new schedule of prices, effective now. This announcement has appeared in the newspapers of forty-nine cities. The automobile world—the entire reading public—will be amazed that this announcement, involving as it does lower prices for 1911 models, is made during the New York Show, which is the signal for heavy buying to begin.

We therefore earnestly request you to read every word on this page. It marks the beginning of a new epoch in motor car history—the establishment of new automobile standards—the attainment of which was only possible through the co-operation and organization realized in the formation of this company.

We manufacture one-fourth of all the motor cars made in the United States and one-sixth of all the cars made in the world. We control all our manufacturing processes.

Cars Made by United States Motor Company Organizations

Ranging in Price from $450 to $8000

BRUSH, formerly $485, is now **$450**
This is the standard runabout, model E

Roadster, Model E 26, formerly $600, now with equipment extra **$485**

MAXWELL, 16 H. P. runabout **$600**
This **Model AB Runabout** now includes $70 equipment, consisting of top, gas lamps and generator, at the former $600 price.

Model Q, 22 H.P., 4 cylinder, formerly $900, now **$750**

Model I, 25 H.P., fore-door touring car, formerly $1100, equal to any car in the $1250 class, now **$950**

Model EA, 30 H. P., fore-door touring car, formerly $1600, equal to any car in the $1500 to $1800 class, now **$1350**

SAMPSON 35, touring car, a recent addition to our line, is listed at a price to command instant attention . . . . . **$1250** to **$1325**

STODDARD-DAYTON models, from **$1175** to **$4800**
These models are all unchanged in price, but in every case show worth higher than the 1910 models. The **50 H. P. Stoddard-Dayton** is distinguished by exceptional refinements.

COLUMBIA, a new model, for **$3500**
Higher powered and more exquisite finish at a slightly higher price than formerly.

Both **Stoddard-Dayton** and **Columbia** cars stand for the limit of motor car excellence and luxury regardless of price. No better cars can be made until the world's engineering knowledge is enlarged and the skill of its craftsmen is heightened.

BRUSH DELIVERY, formerly $685, now . . **$650**
This is the 600-pound delivery wagon.

SAMPSON TRUCKS, 1000 pound delivery motor, 1 ton, 2 ton, 3 ton, 4 ton, 5 ton trucks, and 20 to 40 ton road trains, ... **$1150** to **$8000**

GRAY Marine and Stationary Engines—Recognized as standard all over the world.

18 Plants—Capacity 52,000 Cars—52 Models—14,000 Employees—34 Branches—Dealers Everywhere

THIS readjustment of values is the logical result of the original plan, policy and ideal to which the United States Motor Company owes its birth. Patiently and persistently we have worked to this end—harmonizing, organizing, specializing—always seeking to increase the efficiency of our organization, to improve the quality of our product—always with the ultimate aim in view—the attainment of an unquestioned leadership, because deserved.

The United States Motor Company is composed of 11 constituent companies—each the leader of its class. It operates eighteen separate factories, with a combined floor space of 49 acres. It employs 14,000 skilled artisans and a corps of original investigators, the benefit of whose work is shared by all the companies alike. The individual genius which built up each successful constituent company still directs it, but spurred by friendly rivalry to greater exertion. The broad plans and policies of the parent company are outlined and executed in the fulness of the combined experience of these men.

The product of these companies includes 52 different models—cars designed for every need, utility and pleasure vehicles, for passenger and freight carriage. They range in price from $450 to $8000.

OUR selling organization embraces 34 branch houses and dealers everywhere. This distribution not only enables us to dispose of our product at the lowest selling cost, but it permits us to provide a service organization to maintain these cars in the hands of owners that cannot be duplicated by any other company.

And this organization is owned by upward of a thousand stockholders scattered all over the country; is operated on a co-operative basis, with all our employees working whole-heartedly for our success and sharing in our prosperity, while the executive management is based on military dicipline. No one man, no clique, holds the majority of the stock. Our stock can be bought in the open market by any one, therefore "control" depends only on efficiency.

IN BUYING raw material we are able, by massing our purchases, to secure lower prices and maintain higher quality. By interchange of experience in our engineering department, we avoid costly mistakes and produce better cars. Our original investigations which produce improvements cost little when distributed over our vast product. An improvement in method is introduced immediately in all our plants.

If particular skill and equipment produce better results in one place, all work of this character is done there.

By co-operative selling it is possible for one factory to sell in places where it would otherwise be possible to sell only at a prohibitive cost. Not only does this saving benefit the purchaser, but the service that can be rendered to the owner after purchase could not be given in this locality by any other plan at any practical expense.

WE HAVE conducted this getting-ready process persistently and patiently, untroubled by temporary or local conditions in the industry. While others were cutting prices to dispose of old stock or left-over cars, or to raise cash, we said nothing; we were not ready. We have now reached the point where the fruit of our effort can be given to the buyer without sacrificing the interests of our stockholders.

We make a profit at these new prices. Had we needed to unload we would have announced them four months ago. We have no left-over cars, no old stock to work up. As a matter of fact, our shipments for three months ending November 30 were 57½ per cent. greater than for the same period in 1909.

The season for the heaviest buying is now just about to open. Over ninety-five per cent. of our product is already contracted for with deposits. Every indication points to a shortage of our cars this Spring.

Nevertheless, by basing our prices on a cost which is lowered by legitimate saving, made possible through the benefits of co-operative organization, we are establishing our Company, now and for all time, in public confidence and earning the support which we expect always to retain.

In the preparation of this advertisement I have been keenly interested. I have gone over every item point by point from your point of view as well as from mine. I am satisfied with it. I vouch for its truth, for the sincerity of purpose and for every single statement of fact which it contains. I commend it to your attention. I ask for your order.

Benj Briscoe President

United States Motor Company

Broadway and 61st Street
New York City

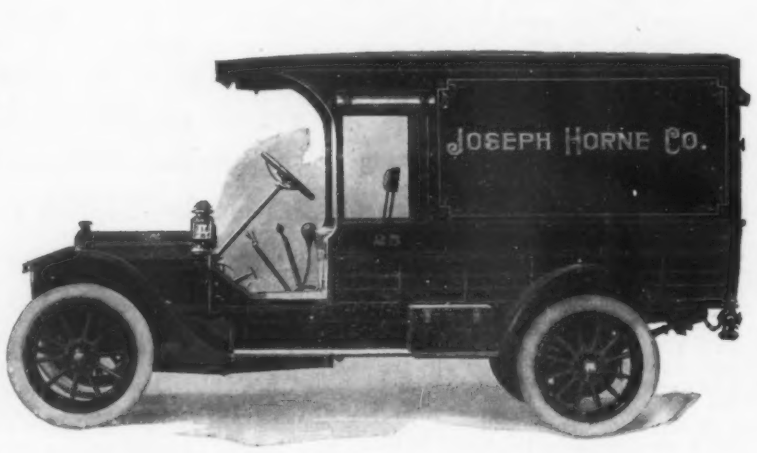
All Our Cars Are Licensed Under Selden Patent

Maxwell-Briscoe Motor Company — **Dayton Motor Car Company** — **Columbia Motor Car Company**
Providence Engineering Works — **Brush Runabout Company** — **Briscoe Manufacturing Company**
Alden Sampson Manuf't'ing Company — **Westchester Appliance Company** — **Courier Car Company**
Gray Motor Company and United International Motors, Ltd., London

EACH TRUCK DOES THE WORK OF SIX TO EIGHT HORSES

WHEREVER teaming is done—wherever men need to transport commodities, there White trucks are successful. We know that they do the work better, faster and more economically than teams—each truck replacing from six to eight horses. If you have a stable of six to eight horses required for delivery work, you know what it costs to keep such a stable running. If you have two, three, four or ten times this number, you are all the more impressed with the cost of your delivery plant. Just think of it—one White gasoline truck will replace—do the work of three to four teams more reliably, more certainly than horses, and with this unit as a basis you can soon tell how many trucks you need for your delivery plant. The trucks are untiring, capable of being worked twenty-four hours a day. They furnish a better looking delivery, stamping the owners as progressive and up-to-date; but better than all, they are cheaper. If Motor trucks appeal to you in any other sense, White motor trucks must reach you by the saving they make possible in your business.

WHITE MOTOR TRUCKS WELL BUILT



WHITE motor trucks are just as well built as it is possible or practical to make them. Wherever strength and toughness is needed, heat-treated, chrome nickel steels are used—wherever hardness and resistance is required, vanadium steels are used. All that these scientific heat-treated steels can do to make frames, motors, transmissions, in fact, every part of the truck wear resisting, tough and strong, has been used in White construction. In other words, The White Company are building trucks—not for today, nor tomorrow, but trucks that must endure, making horses impossible because their service is too costly. White trucks are economical because the engine is well designed—the long-stroke engine being the biggest step forward ever made in gasoline engine building for economy's sake.

¶ Every test of White trucks demonstrates a great abundance of power in the White engine, and yet, this power is not obtained at the expense of economical operation. Why not let us tell you of the actual experience of owners with White trucks—let them give you the detail of upkeep costs—let them prove to you that you cannot afford to be without motor trucks—your business judgment will dictate the rest.

The White Company

838 EAST SEVENTY-NINTH STREET

CLEVELAND